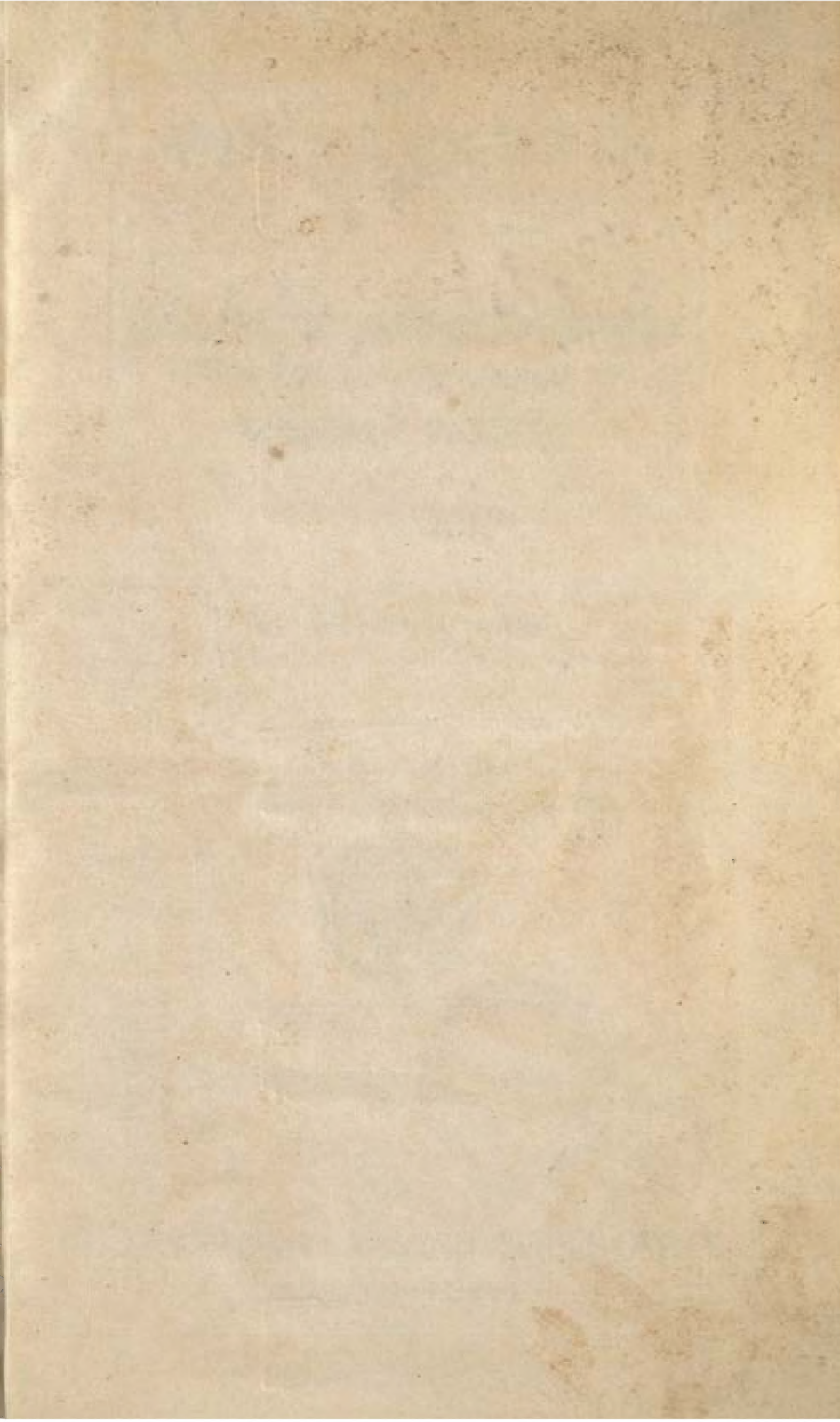


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CONCEPT OF AGNI IN ĀYURVEDA
WITH SPECIAL REFERENCE TO
AGNIBALA PARĪKṢĀ

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BY
Vd. BHAGWAN DASH



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P R E F A C E

The thesis on the Concept of *Agnt* in *Āgurveda* with Special Reference to *Agnibala-parīkṣā* was one of the nine I had to personally guide and direct when I was working as the Professor of *Kāyacikitsā* at the Post Graduate Training Centre in Ayurveda, Jamnagar. This thesis was ranked first by the eminent adjudicators to whom it was referred. The present publication of it in the form of a book involving some minor changes is meant to provide carefully assessed and critically evaluated data gathered by Shri Bhagwan Dash for the benefit of teachers, Post-Graduate students and Research workers in the field of Āyurveda.

Recent researches in the history of the evolution of medicine in India have shown that by about the third millennium B. C., the medical knowledge had reached its apogee and crystalised into broad based generalizations, positive concepts and principles. There is evidence to show that these concepts and principles represented a high stage of development of medicine at that time. It is recognized today that Āyurveda itself was the outcome of changes of an evolving society. Accordingly, many practices were susceptible to modifications or changes in keeping with the needs of growing urban community. However, the savants of Āyurveda took care to enunciate some of the basic concepts and principles in such a manner as to enable their application at all times, regardless of the changes in the social, environmental and other conditions. It is thus seen that, both Agniveśa and Vāgbhaṭa laid emphasis on ten important factors that may have to be examined before arriving at a diagnosis and the determination of the line of treatment in any given disease, regardless of whether they have been described in the classical text or not. The ten factors referred to above are : *prakṛti*,

vikṛti, *sāra*, *saṁhanana*, *pramāṇa*, *sātmya*, *sattva*, *āhāraśakti*, *vyāyamaśakti* and *vayas*—cf. *Caraka : Vimāna* 8 : 94. (According to Vāgbhaṭa, these ten factors are *dūṣya*, *deśa*, *bala*, *kāla*, *anala*, *prakṛti*, *vayas*, *sattva*, *sātmya* and *āhāra*—cf. *Aṣṭāṅgahṛdaya : Sūtra* 12 : 67–68). It is seen from the discussion recorded in the texts that these factors should invariably be examined both subjectively and objectively. It is, however, seen that the extant editions of the *Saṁhitā-granthas* have neither described nor indicated the methods and techniques for carrying out critical investigations of these factors, except for stating, for example, that the status of the *agni* should be examined with reference to its power to digest and metabolise foods ingested (*agniṁ jaraṇaśaktiṃ parikṣeta*) and the strength by ones ability to work, i.e. exercise (*balaṁ vyāyamaśaktiṃ parikṣeta*). It is difficult to believe that the authors of the classical texts would have deliberately ignored the methods and techniques of the examination of these ten factors. The only inference that could be drawn is that either the methods and techniques were imparted by the teacher to the taught orally or, at some point, in the History of Medicine in India, writings on the methodology and technique were irretrievably lost. In the result, critical examination of the ten factors which included *agni* also became a matter of academic interest and hardly of any practical significance.

This is a grave shortcoming which has to be rectified sooner or later, better sooner than later, if the practice of *Āyurveda* is to be meaningful, fruitful and rational. It was with a view to remedying this short-coming that Shri Bhagwan Dash selected the *Concept of Agni in Āyurveda* with Special Reference to *Agnibala-parikṣā* for study. His intention in doing so was to bring together all the material relating to the concept of *agni* from different sources, critically evaluate them in the light of advances made by biochemistry in the related fields, and work out methods and techniques for determining the *agni-śakti* and *bala* which can be standardised and applied in practice. His approach has been refreshingly novel, bold and imaginative. In doing so, he built up his hypothesis

exclusively on the basis of references gathered from the classical Ayurvedic texts and commentaries on them. He has put tshi hypothesis to experimental tests, adopting some of the modern biochemical parameters. As a humble student of science, he has not dogmatised his findings but has shown a way and indicated an approach to the problem and suggested that the methods he has worked out may have to be standardised in a large number of cases. This is indeed a valuable contribution and my own share in this work was to guide and bless him in his endeavour which were carefully planned and executed.

I have only to add by the way of a compliment to Shri Bhagwan Dash that he was one of my most exacting students which I believe is one of the best qualifications one can think of a good student.

Dated 22nd May, 1970.

C. Dwarkanath

INTRODUCTION

In the progressive days of Āyurveda, Physicians in this country were the foremost exponents and all round practitioners of their time, teaching and practicing all the eight branches of the Science of Medicine. There is a recorded history that students from all parts of the Globe came to have their under-graduate as well as post-graduate studies in the Medical Faculties of some of the famous Universities of ancient India, namely, Taxila and Nalanda. Due to various reasons State patronage was withdrawn from Āyurveda and transferred to those systems of medicine which were of choice of the then rulers of the country. This led to stagnation, obstructed progress, stunted growth and partial functioning from the affects of which Āyurveda is still suffering.

This period of decadence which can safely be said as the dark age for Āyurveda, has given birth to many misconceptions and often these are incorporated into the texts in various ways. Because of this confusion, one often overlooks the genuine concepts having scientific value and considers them as either wrong or commonsense and this deters him to find out the scientific validity of these statements.

There are many scientific concepts in Āyurveda which need detailed scrutiny to assess their utility in the field of science. The concept of *agni* is one such factor, a study on which is attempted here.

Agni is one of the ten factors which are required to be examined before initiating the treatment of a patient. The role of *agni* in the animal body is very much emphasised. It is stated that all internal diseases are caused by the vitiation of this *agni*. This is the pivot round which the remaining factors responsible for the maintenance of health and causation of diseases as well as decay revolve.

Human body is considered in ancient Indian scriptures as a replica of the universe; whatever is available in the universe

they are all represented in the human body, may be in a modified form. The physical *agni* (fire) is directly linked up with the biological *agni* inside the human body.

Sāṃkhya, *Nyāya-Vaiśeṣika* and other systems of natural philosophy deal with the fundamental principles of Āyurveda. It is, impossible to explain or comprehend the biological phenomena described in Āyurveda without having a good background of the material objects enunciated in these ancient philosophical works. In fact a rational explanation of various aspects of *agni* can better be provided if its relation with physical *agni* is elucidated. It is with this in view that in the section-I, *agni* as conceived in the *Sāṃkhya* system of philosophy is explained. The *Parīṇāmavāda* which is a logical corollary of *Satkāryavāda* explaining the theory of evolution of the universe provides a rational explanation for the evolution of *rūpātmanā* in which *rajas* is patent, *tamas* is latent and *sattva* is sub-latent. It has been shown in the first section that the phenomena of *rajas* or *agni* represented in the forces or motion, radiation, heat, electricity and magnetism are implicit in the concept of and potential in the *rajoguṇa* of *Mūlaprakṛti*.

In the section-II of this work the concept of *agni* as developed in *Nyāya-Vaiśeṣika* system of philosophy is explained. There is striking similarity in the concept of physical *agni* as expounded in this system of philosophy and biological *agni* described in Caraka. *Agni* according to *Nyāya-Vaiśeṣika* is divided into three categories, namely :

- (i) *Bhāuma* or the physical fire;
- (ii) *Dīvyā* or the celestial fire like the lightening, rays of the Sun, Moon and the Stars;
- (iii) *Audāryā* or the abdominal fire which is responsible for the digestion as well as metabolism and,
- (iv) *Ākaraja* which is present in the metals such as gold and silver.

Combination of *agni* with a material object results in various types of transformations. In the *Nyāya-vaiśeṣika*, there

is a rational explanation about the various types of changes, the material objects undergo when they come into contact with *agni* or physical fire. This concept is very relevant inasmuch as it provides some lead about the transformation which the food ingredients undergo in the human body by the reaction of the digestive enzymes which represent the biological *agni*. It has been shown in this section that the matter and energy are separable only up to a certain level beyond which they are inter-changeable and inseparable from each other.

In Section-III the concept of *agni* as developed in Āyurveda is explained. The concept of *agni* is implicit in the concept of *pitta* described in Āyurveda. The roots from which the term *pitta* is derived connote three important aspects of this, namely, it produces heat, it helps in the burning of food and it controls the various psychic factors which facilitate the individual to achieve *siddhis* or spiritual perfection. The relation between *pitta* and *agni* is fully explained in this Section. The physical characteristics and chemical composition of *pitta*, and its mode of formation in the human body are explained with special reference to the data available in the modern biological sciences. The importance of *grahāṇī* as the site of *pittadharūkālā* has been elaborated. The term *grahāṇī* is generally translated as duodenum, but from the functions, attributed to it in āyurveda, it can be safely said that the part of the alimentary tract extending from the lower part of stomach to the end of the small intestine should be taken as *grahāṇī*. With a view to illustrate the function of this part of the body, the knowledge available in modern biology is incorporated in this work. Several other organs which help in the function of this *grahāṇī* and linked up by ducts and channels with the duodenum and small intestine, are also described along with their functions. Different states of *agni* are described in āyurveda. They are *manda* or mild, *tikṣṇa* or aggravated, *viṣama* or irregular and *sama* or balanced. The signs and symptoms of these states of *agni* are described in āyurveda and during modern times there are certain diseases or disease-syndromes which simulate these states of *agni*. The gastro-intestinal tract has been divided into different

physiological as well as anatomical components. To a person not acquainted with this concept, they may appear to be a contradiction. This point has been elucidated in this section. *Koṣṭha* which represents the gastro-intestinal tract and its various appendages including the organs which are developed from the ectoderm during the process of embryonic development are fully explained.

The process of digestion of food described in āyurveda is based on a slightly different approach inasmuch as the physical state of food after different stages of digestion is taken into consideration and not the chemical transformations. A detailed description of *madhura-bhāva*, *amla-bhāva* and *kaṭu-bhāva*, along with the various important factors which regulate these three stages of digestion are described. Changes which occur in the body because of its coming into contact with various types of digestive enzymes are explained. Apart from the explanation of the digestion in the gastro-intestinal tract, processes of *bhūtāgni-pāka* by which the heterogenous material which come in the form of food to human body becomes homogenous is explained.

Channels which carry the food after digestion have a very important role to play in the physiology of the human body, and the concept of *srotas* specially the role of the liver in the process of digestion has been fully explained. After the food ingredients are made homogenous, the process of synthesis of various types of tissue elements takes place, and for this type of synthesis, a unique concept is envisaged in āyurveda. The role of various types of enzymes which take part in the synthesis of various products and the process by which metabolic equilibrium is maintained are also explained. Different states of *agni* (digestive enzymes) directly influence the various events in the human body. A correlation of these two factors incorporating the known knowledge available in modern biology has been brought out.

The product of digestion has to be carried to the stable tissue elements through specific channels. Any obstruction in the channels produces disease and decay in the individual.

Efforts have been made to corroborate the concept of capillary system with that of *dhātu-vaha-srotāṇi* described in āyurveda. The role of *agni* in the maintenance of metabolic equilibrium and the production of *āma* or the uncooked material in the event of any derangement in this *agni* or metabolic enzymes have been explained. Several psychic events also regulate the production of these enzymes. *Āmadoṣa* is considered in āyurveda to be responsible for the production of all types of internal diseases. Even diseases caused by external agents are actually manifested only when there is production of *āmadoṣa* and subsequent vitiation of *agni* which is present in that locality. The role of *krimis* or germs in the manifestation of diseases has been fully recognized in āyurveda. It has also been described that some of these germs are helpful for the maintenance of human body. This concept appears to be mundane in its outlook. The role of germs in the production of diseases, specially with reference to *āmadoṣa* has been explained. *Āma* or uncooked material may be produced in the gastro-intestinal tract if the local enzymes are deranged. Similarly, *āma* can be produced at the level of the tissues if the enzymes responsible for the synthesis of a particular type of tissue element are deranged. The process by which different types of *āma* are formed both in the gastro-intestinal tract as well as at the level of tissue elements is explained in greater detail.

Agni, apart from the digestive function, is also responsible for the production of strength which has two aspects, namely, (1) strength to resist the occurrence of disease and decay in the human body and (2) strength to perform physical exercises. *Bala* or strength is in fact a direct product of the tissue metabolism which produces energy and heat. In Section-IV different methods and different factors from which the strength of *agni* of the individual body can be ascertained are explained and the data available in āyurvedic literature for ascertaining the state of *agni* in the individual's body from outside symptoms with special reference to the constitution of the individual, season, age and other physical signs and symptoms are des-

cribed. Stool or *śakṛt*, is one of the important products of digestion and metabolism. Apart from the refuse of the food ingredients, certain endogenous elements come out through the stool. Any change in the process of metabolism affects the endogenous fraction of the stool resulting in a change in its physical as well as chemical characteristics. An effort has been made to ascertain the state of *agni* inside the human body from various characteristic features of the stool. Some other symptoms which indicate the function of *āmāśaya* and *pakvāśaya* have been described. Other symptoms indicating the impairment of the functions of gastro-intestinal tract and *dhātvaṅni* are also described.

The material and method actually followed to ascertain the strength of *agni*, digestion and metabolism, and *māṁsabala* (physical strength) are then described. Various criteria fixed in determining these factors and parameters decided for drawing of conclusions are also described.

Special emphasis is then laid upon the determination of the *agni* of different *dhātus*. Diseases produced by the derangement of *agni* of these *dhātus* are then explained specially with reference to those described in modern medicine.

In the discussion that follows, the data collected by experiments on volunteers and patients have been described and the criteria of demarcating an individual as of *pravara-bala*, *madhya-bala* and *avara-bala* are also described.

Because of the centuries of accretions, the theories and concepts we find at present in the works of ancient medicine, are interpreted to be commonsense and not scientific knowledge. It is perhaps necessary to examine the difference between the scientific knowledge, the knowledge of commonsense before the statements including theories and concepts of āyurveda could be put in one or the other category. Very generally described, commonsense is the aggregate of views commonly held by a group of people without seriously questioning their bonafide. In other words, commonsense knowledge is the knowledge of the first look, knowledge which is

self evident or obvious to any one who is possessed of normal intellectual powers. Science is designated as trained and organized commonsense. Here lies the subtle difference of profound importance. The essence of science lies in the critical technique which is lacking in commonsense. The scientific knowledge is much more rigorously controlled. It is more penetrating in its analysis, more far-reaching in its scope and more carefully guarded in its evaluations and interpretations.

Examined with the above parameters, concepts and theories of āyurveda are scientific except of course those which were interpolated into the texts by people who are not entitled to do so during the period of decadence of the science. It is perhaps necessary in this connection to quote the views of Capt. G. Srinivasa Murthi expressed in his memorable monograph on "The Science and Art of Indian Medicine" (1923). According to him "The Indian systems *'of' medicine* (italics mine) are undoubtedly scientific; their general principles and theories (both in subjects of preliminary scientific study like Physics, Physiology and the like, as also in the subjects of medical science proper, like Pathology, Medicine, and so on) are quite rational and scientific." What is, therefore, now required is to provide the missing links in this field. Concepts and theories are required to be verified with a view to ascertain that they are not the unscientific interpolations made during the period of decadence, and then through scientifically planned experiments, data should be collected to improve upon these scientific concepts and theories. Simultaneously there should be an attempt to demonstrate their applied aspects in the field of diagnosis and treatment of diseases. The present work is an attempt on this line.

Dated 30-7-70.

Bhagwan Dash

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CONCEPT OF AGNI IN ĀYURVEDA
WITH SPECIAL REFERENCE TO
AGNIBALA PARĪKṢĀ

SECTION I

AGNI AND THE SĀMĀKHYA SYSTEM

Agni, in the *Sāṃkhya* view, is potentially present in the *rajoguṇa*¹ of the *mūlaprakṛti*—the other two *guṇas* being, *sattva* and *tamas*. The *triguṇas*, in the *Sāṃkhya* view, are considered to be the ultimate reals (*tattvas*). An enquiry into the ultimate factors of creation, according to this system, was based on :

(a) *Satkāryavāda*—the doctrine of quantitative permanence and indestructibility of matter—corresponding to the law of conservation of energy (mass), which is basic to modern physical and chemical sciences ;

(b) the doctrine of *pariṇāma*—the theory of evolution—a logical corollary of *satkāryavāda* ;

(c) the doctrine of '*Kāraṇa* and *kārya*'—the law of causality;

(d) the doctrine of '*Kāla* and *dik*'—the theory of time and space ; among others, leading to the conclusion that the phenomenon of the universe one observes, is the outcome of the evolution of the primordial-matter-stuff or '*mūlaprakṛti*' which is represented by three components of its pattern—spoken of as *triguṇas* viz., *sattva*² *rajas*³ and *tamas*.⁴ *Sattva*, *rajas* and *tamas* represent the essence or intelligence, the energy or motion and the inertia or mass respectively at the material and physical (including biological) planes and pleasure, pain and delusion respectively, at the psychological plane. According to the *Sāṃkhya Kārikā*, the *guṇas* are of the nature

1. The *rajasika* component of *prakṛti* is also described as *taljara*—meaning, related to *agni*.
2. *Sattva* is signified by whatever is pure, fine and illuminating (Fundamental Principles of Ayurveda by Dr. C. Dwarakanath Part II, p. 36).
3. *Rajas* is signified by, whatever, is active and energetic (*Ibid.*).
4. *Tamas* is signified by whatever is passive and whatever offers resistance and restraint (*Ibid.*).

of pleasure, pain and delusion and, they are adopted to illuminate, activate and restrain. They mutually suppress, support, produce, concert and exist.¹

The *guṇas* are stated to be in an equilibrated quiescent state, in the *sāmyāvasthā* of *mūlaprakṛti*. When possessed by *puruṣa*, a non-physical factor of consciousness and intelligence—the *sāmya* of the *mūlaprakṛti* is stated to be disturbed, and the *triguṇas* collocate with one another, in an unequal distribution, within the *mūlaprakṛti* itself. They unite, separate and reunite. The things of the universe are evolved due to the peculiar property of *triguṇas*, mentioned above viz., their capacity to combine, separate and recombine, in various modes of groupings. Even though, they react and interact with one another, they are, none-the-less, independent. The evolution of the definite from the indefinite and qualitatively determinate² from the indeterminate takes place, due to this peculiar feature of *triguṇas* and the diversity of effects, observed at the phenomenal level, which characterise the things—physical, material, biological and mental are also due to this peculiarity.

It has been stated that “In the evolution of *mūlaprakṛti*, *sattva* and *tamas* by themselves, are incapable of performing any work. The various functions attributed to them are, in this view, due to *rajas* (energy) only, which on the one hand overcomes resistance and supplies energy on the other. Even so, *sattva*, also, needs the help of *rajas* (energy) to enable conscious adaption.”³ Thus, it would seem that, the energy present in the multiplicity of diverse things in the phenomenal⁴ universe is entirely due to *rajas*; resistance and

1. प्रीत्यप्रीतिविषादात्मकाः प्रकाशप्रवृत्तिनियमायाः ।

अन्योऽन्याभिन्नवाश्रयजननमिथुनवृत्तयश्च गुणाः ॥ (Kārikā xii).

2. एते गुणा इतरंतराश्रयेण उपाजितस्तुल्यदुःखमोहप्रत्ययाः । Vyāsa-bhāṣya on Yogasūtra 2 : 15.

3. अन्योऽन्याभ्याम् अहंकाराभ्यां स्वकार्योपजनने राजसाहंकारः सहकारी भवति । (Lokācārya; Tivvatraya, Acit prakaraṇa).

4. Phenomenon stands for the term *vyākṛta* and is the “form through which, it (the thing) becomes known to the senses or under-

stability to *tamas*; and every conscious manifestation to *sattva*.¹ In any phenomenon, therefore, the particular pattern i.e., *guṇa*, which happens to preponderate over the rest (the remaining two *guṇas*), become manifest and others are sublatent. The presence of the latter is to be deduced from their observed effects. This aspect has been very ably summed up by Seal as : "In any material system at rest, mass is patent, energy is latent and conscious manifestation is sub-latent."² In the case of an active dynamic system, on the other hand, *rajas* (energy) is a dominant feature and the resistance to *tamas* (mass or inertia) is overcome. The transformation of *rajas* or energy is stated to proceed, hand in glove, with the preponderance of *sattva* and, in such cases, volitional consciousness accompanies the movement of *rajas* (energy) in phenomena, where, the former is predominant. In this instance, resistance to *tamas* (mass or inertia) is deduced to be overcome.³

Keeping the foregoing principles in view, it may not be difficult to follow the *Sāṃkhya* theory of evolution of the macrocosm⁴ and microcosm⁵—the evolutionary steps of moving in consecutive phases, until the state of *Tamasika ahaṃkāra*, known also as *bhūtādi* from which *kāraṇākāśa* has been reacted. It is at this point, metaphysics merges into physics. *Kāraṇākāśa* corresponds to quiescent energy in the continuum, which constitutes the "sole physical constituent of

standing." It is the opposite of noumenon which means "the unknown, and unknowable substance or thing in itself." (Fundamental Principles of Ayurveda by Dr. C. Dwarakanath : Part I. p. 5).

1. अन्वोन्याङ्गाक्रियावेन उत्पादितेऽपि द्रव्ये प्रकाशगुणः सत्त्वस्यैव, क्रियागुणो रजसएव, स्थितिगुणस्तमसएव । (Yogavārtika on Vyāsabhāṣya on Yogasūtra 2:18)
2. B. N. Seal : "The Positive Sciences of the Ancient Hindus," p. 5.
3. प्रधानवेलायामुपदर्शितसञ्चिधाना गुणत्वेऽपि च व्यापारमात्रेण प्रधानान्तर्गतानुमितस्तिताः । (Vyāsabhāṣya on Yogasūtra 2 : 18).
4. By macro-cosm is meant the physical universe or human society as opposed to micro-cosm, the human individual.
5. The term micro-cosm means small universe used figuratively of the human being; also sometimes of the world revolved by the microscope. (A Dictionary of Psychology by James Drever).

the universe," spoken of variously by modern-physics, as the "field-property," "electro-magnetic-field," "undulatory ether" and so forth. From out of *Kāraṇākāśa*, is stated to evolve the *kāryākāśa*, the former having been activated or disturbed by *rajas* or energy—an idea reminiscent of some of the current physical doctrines, viz., the existence of energy in the continuum in two states—quiescent and active, which passes from one state into another. The activation by *rajas* of the *kāraṇākāśa*, leading to the evolution of *kāryākāśa* has a parallel in the modern view, which accounts for the activation of the quiescent energy—Plank's constant 'h'—being suggested as the measure of least impact, that changes quiescent energy. Vijnānabhikṣu has already stated in *Yogavārtika* that *ākāśa* has two aspects—the original and the derivative. The former, in his view, is a continuum (*Vibhu*) non-atomic and that it represents the all-pervasive vehicle or substrate of the ubiquitous energy i.e., *rajas* or *tejas*. The latter is atomic.

At this point, matter is stated not to admit of either addition or subtraction, neither can it be created nor destroyed. The evolution of *tanmātrās*, is stated to follow, soon after—*kāraṇākāśa*, represented by uncharged particles of *bhūtādi*, being charged by varying quanta of *rajas* or energy. Thus, *śabda*, *sparsa*, *rūpa*, *rasa* and *gandha* *tanmātrās*, represent varying quanta of mass and energy. These again collocate in various proportions and modes to form the five *mahābhūtas*.¹

1. षड्विशेषाः तद्यथा शब्दतन्मात्रं स्पर्शतन्मात्रं, रूपतन्मात्रं, रसतन्मात्रं, गन्ध-
तन्मात्रं च इत्येकद्वित्रिचतुष्पञ्चलक्षणाः शब्दादयः पञ्चाविशेषाः ... (*Viśva-
bhāṣya* on *Yogasūtra* 2 : 19) अर्हकारात् शब्दतन्मात्रं, तत्तत्सार्हकृतात्
शब्दतन्मात्रात् शब्दस्पर्शगुणं स्पर्शतन्मात्रम् । एवं क्रमेण एकैकगुणवृद्ध्या
तन्मात्राणि उत्पद्यन्ते । (*Pravacanabhāṣya* on *Sāṅkhyasūtra* 1 : 62).
तद्यथा गन्धतन्मात्रं वर्जयित्वा चतुस्तन्मात्राणां स्नेहजातीयानां एकः परिणामः
जलपरमाणुः, तेषां च महाजलादिः । एवं च गन्धरसौ वर्जयित्वा औष्ण्यजातीयानां
त्रितन्मात्राणां तेजो अणुः, तेभ्यो महातेजआदिः, एवं गन्धरूपरसाणां वर्जनात्
द्राव्यां वाय्वणुः, तेभ्यो महावाय्वादिः । एवं शब्दतन्मात्रात् अर्हकारांसहकृतात्
आकाशाणुः, तेभ्यो महाकाशादिः । ... अत्र दर्शने अयं सिद्धान्तः शब्दादि-
तन्मात्रपञ्चके काठिन्यस्रोहादिभ्यः पृथिवीत्वादिकातयः मन्ति ... (*Yoga-
vārtika* : on *Yogasūtra* 4 : 14) अत्रायं क्रमः—भूतादेः शब्दतन्मात्रं
जायते, शब्दतन्मात्रं भूतादिरावृणोति, तत् आकाशं जायते, ततः अस्मात्

It will be seen from the foregoing that, in dealing with *rajas* (energy) at different levels of the evolution of *prakṛti*, we are in fact, dealing with the problems of entropy.¹

An important point to note here is the fact that, at the level of *rūpa tanmātra*, *rajas* is patent, *tamas* is latent and *sattva* is sublatent. The main property attributed to this *tanmātra* is radiation and heat—its other properties being vibration (*parispandana*) and motion (*vega*). Since *tanmātras* are also stated to evolve in a consecutive series of five steps, the first step

शब्दतन्मात्रात् स्पर्शतन्मात्रं जायते स्पर्शतन्मात्रं शब्दतन्मात्रमावृणोति, एवं शब्दतन्मात्रावृतात् आकाशसहायकात् स्पर्शतन्मात्रात् वायुर्जायते, ततः अस्मात् स्पर्शतन्मात्रात् रूपतन्मात्रं जायते, रूपतन्मात्रं स्पर्शतन्मात्रमावृणोति, एवं स्पर्शतन्मात्रावृतात् वायुसहायकात् रूपतन्मात्रात् तेजो जायते and so on; अयं क्रमः तत्त्वत्रयविवरणे कृष्णपादैरुक्तः । वरवरमुनि तत्त्वत्रयभाष्य, (अचिद्वि प्रकरण) ।
(Extracted by Sir B. N. Seal, In his Positive Science of Ancient Hindus : pp. 26-36).

1. The concept of entropy can be briefly summed up as follows : Natural events tend to change from improbable (*aviśeṣa*) situations to more probable (*viśeṣa*) ones. The degree of improbability is ultimately determined by the amount of energy (*rajas*) required to maintain a given situation. Zero energy expenditure is equivalent to least improbability i.e., maximum probability or certainty. This concept can be illustrated as follows : The total environment, physical, chemical or biological, display a tendency towards balanced stability. For example when a glass of water is shaken, the fluid surface oscillates up and down; by oscillating, the system accommodates to the initial disturbance until the force of the latter is spent, and a stable condition is again attained. Events on earth can be compared to the seesawing of water. This initial disturbance was the cause of the formation of the solar system. Ever since environmental oscillation occurred—as they will occur in future also—tending to establish a stable balance, but such a balance cannot be attained as long as the sun shines and the earth spins; every imbalance creates a subsequent imbalance which tends to counteract the first. This, in essence, is the response principle, which moves the whole environment including the living system.

being represented by *śabda-tanmātra*, the second by *sparsa-tanmātra*, the third by *rūpa-tanmātra*, the fourth by *rasa-tanmātra* and the fifth by *gandha-tanmātra*; the relative status of *rajas* and *tamas* is gradually found to change, that, in the case of *rasa* and *gandha tanmātras*, *tamas* becomes patent, *rajas* latent and *sattva* sub-latent. In other words, uptill the *rūpa-tanmātra* energy is manifest, and beyond this level, mass and inertia become more preponderant. However, *rajas* or energy is implicit in all *tanmātras*, as indeed in all the *sthūlabhūtas*, which latter represent *tanmātric systems*.

Thus, the phenomena of *tejas* or *agni*—understood at the phenomenal level, in many forms viz., the forces of motion, radiation, heat, electricity and magnetism (including forces of cohesion and friction) is implicit in the concept of and potential in *rajoguna* of *mūlaprakṛti*. The origin of *agni*—both the physical and biological is, therefore, to be traced to *rajoguna* of *mūlaprakṛti*. By implication, all the active and productive aspects of *pariṇāma* or evolution, at the macro- and micro-cosmic levels are due to *rajas* (energy).

SECTION II

AGNI IN NYĀYA-VAIŚEŚIKA

According to *Nyāya-vaiśeṣikas*, *tejas*, in which *agni* is implicit, is one of the *navadravyas*¹ and, it is represented by *tejasparamāṇu*. One of the properties ascribed to *tejas paramāṇu*, by *Nyāya-vaiśeṣikas*, is heat.² Caraka has included *tejas* among the group of fundamental substances.³ Both *Nyāya-vaiśeṣikas* and Caraka have treated *tejas*, just like *pṛthvi*, *ap*, *vāyu* and *manas*, as *aṇu*.

The *Nyāya-vaiśeṣika* school of natural science, representing the 'doctrine of commencement or *ārambhavāda* has postulated the view that, the order of creation must primarily be in the nature of creation, first, of the atoms or *aṇus* of *vāyu*, *tejas*, *ap*, *pṛthvi* and *manas* and, the things of the universe arise out of two or more atoms of these elemental substances being put together. This school of scientific thought has subscribed to the doctrine of a manifold of ultimate "reals or *tattvas*," whose atoms combine variously, to form the things of the universe.

The *ārambhavādins*, like the earlier physical chemists of modern times, described *aṇus* as follows: by dividing and subdividing things, a stage is reached, when, further division of matter is no longer possible. The matter, at this stage, is the *aṇu*.⁴ According to Kaṇāda the union or combination of

1. तत्र द्रव्याणि पृथिव्यप्तेजोवाय्वाकाशकालदिगात्मनोऽपि नैव ।

(Tarkasaṃgraha).

2. उष्णस्पर्शवत्तेजः । (Ibid).

3. खादीन्यात्मा मनः कालोदिशश्च द्रव्यसंग्रहः । (Caraka : Sūtra 1 : 48).

4. Robert Boyle (1627-1691) postulated the principle of the 'elements' or 'first principles,' of which matter was composed. He reviewed the atomic-hypothesis, held by Democritus and Lucretius—the Greek Philosophers—and defined the term 'element' as a substance, which may not be further analysed into simpler substances. However, the difference between the *Gautama cum Kaṇāda* school of thought and that of Boyle's relates

the elementary particles of *paramāṇus*, leads to the production of diverse forms of things. The *paramāṇus* combine, in twos (*dvyāṇukas*) and threes (*tryāṇukas*) and so forth,¹ to yield myriad of new things, arising out of the various modes of their combinations and permutations.

Udayana, in his *Lakṣaṇāvalī* has defined *tejas* as that which is the substratum of colour and which shares a common substratum with the absolute absence of taste.² *Kaṇāda-rahasya* has stated that "Tejas is that which has a common substratum with colour but not with weight. This represents the special feature of *tejas*."³ According to *Vyomavati*, quoted by Umesha Mishra, the qualities of *tejas* can be summed up as follows—*rūpa* (Colour), *sparsa* (touch), *saṅkhyā* (number), *parimāṇa* (dimension), *prthaktva* (separateness), *saṁyoga* (conjunction), *vibhāga* (disjunction), *paratvāparatva* (priority and posteriority) *dravatva* (fluidity), *vega* (velocity)—colour and touch being the only distinct qualities of this element. Its colour is illuminating (*bhāsvara*) and, touch is hot (*ṇṣma*).⁴ According to *Prāśastapāda*, the natural movement of *tejas* is upward.⁵ Its colour and touch do not undergo any chemical change,

to the number of elements, which, in the former case, comprises of five kinds of atoms—*prthvī*, *ap*, *tejas*, *vāyu* and *manas*; whereas, according to latter as further modified by Dalton, envisaged over ninetytwo different elements. According to both the views, an element or *anu*, is a distinct species of matter, which has not yet been shown to be composed of two or more different kinds of matter (each atom is now, again, divisible into many parts viz. proton, electron and neutron etc.)

1. ततः परमाणुद्वयसंयोगे सति व्यणुकमुत्पद्यते । त्रिमिकिमिरेव व्यणुकैस्त्र्यणुकम् । एवं चतुरणुकादि क्रमेण ... । (*Dīpikā on Tarkasaṁgraha*).
2. *Lakṣaṇāvalī* by Udayana : Reprint from the "Pañḍita," Benaras : p. 31. Quoted by Umesha Mishra in his "Conception of Matter" 1936 Edn. p. 329.
3. *Kaṇādarahasya* by Śaṅkara Miśra : Chawkhamba, Benaras-Edition : pages 17, 18, quoted by Umesha Mishra in his conception of Matter, 1936 Edn. p. 329.
4. Conception of Matter by Umesha Mishra, 1936 Edn. p. 329.
5. *Pañḍarthadharmā Saṁgraha* by *Prāśastapādācārya* : Vizianagaram Sanskrit Series Edn. p. 39.

hence, they are *nitya* or eternal in the *paramāṇus* and *anitya* or non-eternal in *kārya* or products. ¹

According to Udayana, the solar-heat is the source of all the store of heat required for chemical change in the world. Citing the example of the colour of grass, he has stated that it (the colour) is due to *tejas* in the form of invisible heat, not in the form of *agni* and, that the cold, in winter, cannot take away the store of heat, derived from the sun. ²

Annambhaṭṭa in his *Nyāyabodhini* on *Tarkasaṃgraha*, has stated, "An unripened fruit ripens, under the influence of solar-heat. Ripening of an unripened mango results in the change of colour, taste and smell etc." This is referable, in his opinion, to the subtle decomposition and recombination (*saṃyoga* and *vibhāga*) that goes on in it. Likewise, is the cause of the rusting of metals in combustion, due to *sūrya-pāka* or solar heat. The conversion of food into *rasa*, and *rasa* into *rakta* are again examples of action due to *jāṭharānala* or *audaryatejas*. The nature of contact with *tejas paramāṇu* or the kind of *pāka* (chemical action which brings about a change, in respect of colour), in his view is different from that which transforms flavour—*vilakṣaṇa-tejaḥ-saṃyoga* and *pāka*. This applies equally to change in tactile quality. ³ The same authority has stated that, the substance *tejas* possesses the

1. नित्यं परमाणुरूपम् अनित्यं कार्यरूपम् । (*Tarkasaṃgraha*).
2. तृणादिविकारो हि यदि रूपादिपरावृत्तिमात्रहेतुः स नूनमौष्ण्यापेक्षेण तेजसा कर्तव्यः । तादृशे च पाके अनिमित्तं हिममिति । न किञ्चिदनिष्टमापद्यते । न हि सौरस्य तेजसः वैलोक्यपाकहेतोः हिमादपगमः क्षमते । अथ विकारो मरुमादिरूपो विवक्षितः । सोऽसिद्ध एव हिमहितेषु तृणादिषु क्व विरोधो बाधा वा । अथ रूपादिपरावृत्तिमात्रेणैव अग्निः साध्यते तदशक्यम् । तस्य दर्शनस्पर्शनग्राह्यस्य योग्यानुपलम्भबाधितत्वात्, अतादृशस्य तेजोमात्रस्य निवृत्तेरशक्यत्वादनष्ट-स्थानम् । (*Udayana : Kīrapāṣvall* सृष्टिसंहारविधिनिरूपणम्)
3. पाको नाम विजातीयतेजःसंयोगः । स च नानाजातीयः । रूपजनकविजातीय-तेजःसंयोगस्तदपेक्षया रसजनको विजातीयः । एवं स्पर्शादौ अपि तथा । एवं प्रकारेण मित्राभिन्नजातीयाः पाकाः कार्यवैलक्षण्येन कल्पनीयाः । तथा हि तृणपुञ्जनिक्षिप्ताग्रादौ तृणलक्षण-विजातीयतेजःसंयोगात् पूर्वहरितरूपनाश-रूपान्तरस्य पीतादिरूपस्य, पूर्वसस्य अम्लरसैवानुभवाद । क्वचित्पूर्वहरितरूप-सत्त्वेऽपि रसपरावृत्तिर्दृश्यते । विजातीयतेजःसंयोगरूपपाकवशात् पूर्वतनाम्ल-

property of heat and could be cognised by tactile perception. It may occur in two forms—(a) *nitya* or eternal (indestructible), (b) *anitya* or transient. The former is in the nature of *paramāṇu* (atomic or corpuscular); on the other hand, the latter is to be understood as *kārya* or effect.¹ *Anitya* or the transient type occurs in three forms viz., (i) *tejas-śarira* or the physical form of *tejas* which is well-known in *sūryaloka* (solar system); (ii) *indriya-tejas* is the sensory form of *tejas*. It is to be seen, at a point, within the black of the eye (pupil). It makes visual perception possible² and, (iii) *viśaya-tejas* or the *tejas* which occurs in the objects of the senses. This variety is of four kinds :

- (1) *bhauma tejas* or *agni* of the earth, such as fire etc.³
 (2) *divya tejas* or the *tejas* of the sky such as lightening, rays of the sun, moon and stars.⁴ (3) *audarya tejas*

रसनाशे मधुररसस्यानुभवात् । तस्माद्रूपजनकापेक्षया रसजनको विलक्षण एवाहोकार्यः । रूपरसयोरपराङ्मूर्त्तौ अपि पूर्वगन्धनाशे विजातीयपाकवशात् सुर-भिगन्धोपलब्धेः । एवं स्पर्शजनकोऽपि पाकवशात् कठिनस्पर्शनाशे मृदुस्पर्शानुभवात् । अतएव पाथिवपरमाणूनामेकजातीयस्वेऽपि पाकमहिम्ना विजातीयद्रव्यान्तरानु-भवः । यथा गोमुक्ततृणादीनां आपरमाण्वन्तं मज्जे तृणारम्भकपरमाणुषु विजातीयतेजःसंयोगवशात् पूर्वरूपादिचतुष्टयनाशे तदनन्तरं दुग्धे यादृशं रूपादिकं वर्तते तादृशरूपरसगन्धजनकास्तेजःसंयोगाः जायन्ते । तदुत्तरं तादृश-रूपादयः उपपद्यन्ते । तादृशरूपादिविशिष्टपरमाणुभिः दुग्धव्यञ्जकमारम्बते । ततः व्यञ्जकादिकमेव महादुग्धारम्भ इति ॥ (Nyāyabodhini on Annam- bhatta's Tarkasamgraha).

1. Light, according to modern view, has got two forms viz., particle or corpuscular and wave. Whenever it hits, whenever it enters our eyes, burns our skin or takes a photograph, then light is said to behave as particles. It is, in the act of getting to us and in particular, the quantity of it that gets to us is stated to behave as waves. Apparently, therefore, the particle or corpuscle represents the *nitya* type of *tejas*. Its wave form occurs as *kārya* or the effect, when it performs *karma* or motion i.e., when it is active. It is in this aspect of *tejas*, that the *anitya* or transient form may have to be understood.
2. This form of *tejas* has been described as *āleśaka pitta* in *Āyurveda*, corresponding to the visual purple of retina described by modern physiology.
3. *Bhauma tejas* : Oxygen, which is responsible for oxidation, is a form of *bhauma tejas*; so also is the case with phosphorescence of the glow-worm.
4. Electro-magnetic phenomenon and the stellar emanations.

or the *tejas* that occurs in the gastro-intestinal secretions, which, latter, are held to be responsible for the execution of the digestion of food and drink ¹ and (4) *ākaraṇa tejas* or the *tejas* present in metals (minerals ?) dug from mines, such as gold, silver etc. ²

Implicit in the foregoing citation is the idea, that heat and light represent the obverse and reverse of the same coin viz., *tejas*.

According to Udayana, heat and light rays are stated to consist of extremely small particles, which dart-forth or radiate rectilinearly in all directions, at an inconceivable speed. ³ The way in which *tejas* in its two aspects viz., heat and light works, has been described by the same authority. According to him heat may either penetrate through the inter-molecular-spaces, as in the case of conduction of heat, which when applied under the pot, boils the water or fries the paddy, without involving the pot in any chemical reaction i.e., causing no decomposition or recombination of its molecules; no change of its molecular collocations, is stated to take place. As regards the phenomenon of translucency or transparency (*svacchata*), light rays, in his view, penetrate through the inter-atomic-spaces, with vibration (*parispanda*) of the nature of deflection or reflection (*tiryaggamana*), very much as when fluids penetrate through porous bodies (तत्र परिस्पन्दः तीर्यगमानं,

2. This corresponds to *pāka pitta* or *jatharāgni*, *dhatvāgni* and *bhūtagni* of *Āyurveda*, which in its turn parallels the enzymes of the gastro-intestinal tract and the other metabolic agents.

3. Ions, radio-active metals and minerals. उष्णस्पर्शवत्तेजः । तद्दिव्यविष्णुः । नित्यमनित्यं चेति । नित्यं परमाणुरूपम्, अनित्यं कार्यरूपम् । पुनस्त्रिविधं शरीरेन्द्रियविषयभेदात् । शरीरमादित्यलोके, इन्द्रियं रूपघाटनं चक्षुः, तच्च कृष्णताराप्रवर्ति । विषयः चतुर्विधः—भौमदिन्यौदर्याकरजभेदात् । भौमं बहुयादि, दिन्यमबिम्बनं विष्णुतादि, मुक्तस्य परिणामहेतुरौदर्यम्, आकरजं सुवर्णादि । (*Tarkasaṃgraha—Tejonirūpaṇa*).

4. अचिन्त्यो हि तेजसो लाघवातिशयेन वेगातिशयः यद्वा प्राचीनावलम्बितवल्बिनि एव भगवति मयूखमालिनि भवनोदरेषु आलोक इत्यभिमानं लौकिकानाम् ।

(Udayana : *Kiraṇāvali-Tejonirūpaṇam*).

परिस्त्रवः पात इति)¹ or in the alternative, they may impinge on *paramāṇus* and rebound back (मूर्च्छनं किरणविघटनं).² They may, also, be obstructed by *anus* in their pathway, leading to degrees of shadows or opacity. All these phenomena are, also stated to be physical and not due to decomposition (*vibhāga*) and recomposition (*saṁyoga*) or the alteration in the molecular grouping.

Light, in this view, may also hit the *paramāṇus*, in a peculiar way, so as to break up their grouping, transform the physico-chemical characters of the *anus* and, again, recombine them due to its chemical impact, at an inconceivable velocity.³ & ⁴

1. Udyotakara on *Vātrīyānabhāṣya* on *Nyāyasūtra* 3 : 1 : 47.
2. B. N. Seal : The Positive Sciences of the Ancient Hindus, p. 116.
3. वर्तितदेशे पिण्डितमपि तेजः प्रसर्पतु प्रसादोदरं व्याप्नोति । तत् कस्य हेतोः ? पृथ्व्यप्रत्वात् । स्वभावतः प्रसरदपि न स्वपरिमाणानुविधायिनं प्रत्ययमाधत्ते, किं तु विषयभेदानुविधायिनं । स्फटिकाद्यन्तरितोपलम्बिरपि प्रसादस्वभावतया स्फटिकादीनां तेजोमतेरप्रतिबन्धकतया प्रदीपप्रभावादेवोपपन्ना । Udayana तेजोमिरूपणम् in reply to the objection यदि हि प्राप्य गृहीयात् प्रतिघातिना स्फटिकद्रव्येण विष्टम्मादप्राप्तं प्रसर्पत्तृणादिकं नाददीत, तस्मादप्राप्यकारि, ततो न तेजसम् Udayana : Ibid : Definition of Svachchāḍa. द्रव्यान्तरासम्भूतद्रव्यसमवायः स्वच्छता । दृष्टव्याप्रतिघातः काचाभ्रपटलस्फटिकान्तरितोपलम्बः । स्थाल्यादिषु च पाचकस्य तेजसाऽप्रतिघातात् । Udyotakara 3 : 1 : 38. आदित्यरश्मेः स्फटिकान्तरितेऽपि दाहोऽभिघातात् Sūtra 47, where Udyotakara notes : कोऽयमभिघातः ? यस्य द्रव्यस्यावयवा न व्युत्पद्यन्ते तस्य अन्तरावयवैः अव्युद्गमानस्य योऽमिसम्बन्धः सोऽभिघात इति । Vācaspati explains यस्य द्रव्यस्य भर्जनकपालादेः अवयवाः पूर्वोत्पन्नद्रव्यारम्भकसंयोगनाशेन द्रव्यान्तरजनकसंयोगोत्पादनं व्युद्गहनं तत्र क्रियते यस्य द्रव्यस्य भर्जनकपालादेरव्युद्गमानस्य अन्तरावयवैः योऽमिसम्बन्धः बद्धेः सोऽप्रतिघातः । अन्तः प्रवेशः कृशानोरनुमीयते । तेन वेगवता बद्धिद्रव्येण नोदनादभिघाताद्वा अवयवेषु क्रिया, क्रियातो विभागः । विभागादारम्भकसंयोगविनाशः etc. Jayanta Bhaṭṭa in *Nyāya Māñjari*, भूतचैतन्य, पूर्वपक्षः । For opacity, shadows, etc. vide छाया तु तेजःपरमाणोरावरणात् भृत्तिमता अस्य परमाणुना तेजःपरमाणुराव्रीयते । यत्र च आवरणं तत्र छायेति । विरल तेजःसम्बन्धीनि द्रव्यगुणकर्माणि छाया इत्यभिधीयते । सर्वतो व्यावृत्ततेजःसम्बन्धीनि तु तानि तमःसंज्ञकानि (Udyotakara, 4 : 2 : 25).
4. This description has a parallel in the Chemical action brought about by ultraviolet and X. rays.

The foregoing are among the few important references to *tejas* (*agni*) in the *Nyāya-vaiśeṣika* system of natural philosophy. There are many more such references but the few cited here would suffice to invite attention to the fact that, these two ancient schools of scientific thought have offered a fully developed theory, relating to light and heat. What is perhaps important in the context of this thesis is the application of these theories in practice, to explain a variety of phenomena which border on thermo-dynamics.

The theories of *Nyāya* and *Vaiśeṣika* relating to *pāka* (chemical action) are based on their concept of *tejas*, *kāla* and *dik*. These theories are germane to this paper.

Nyāya-vaiśeṣika concept of *pāka* (chemical-action) :—*Pāka-kriyā*, as described by *Nyāya-vaiśeṣika* system may sound to be quaint when studied on the background of modern concept of chemical action. None-the-less, they appear to be basically sound, in principle, even when examined from modern points of view. In the view of this system, when an object is brought in contact with *tejas*, motion or *karma* is stated to be produced in the ultimate constituents (*anus*) of that object, due to *abhighāta* ¹ (forcible contact) or *nodana* ² (impulsion) of *tejas*. (The *Nyāya-vaiśeṣikas* reject force operation i.e., *śakti* except as modes of motion—*karma*). This motion, in its turn, is held to produce *vibhāga* (disjunction), which results in this destruction of the *samyoga* (con-

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1. *Abhighāta*, in this context refers to motion, due to direct contact, for an instant, with a body that shrinks and produces an impact, e.g. the case of a stonefall against a hard object the potter's rod striking the wheel and the mortar struck against the pestle. Instantaneous disjunction is necessary to impact.
 2. The motion of an object pushed or pulled by hand; the motion of the mud under heavy stones; the motion of an arrow due to the pressure exercised by the bow-string due to elastic law as it reverts to its original shape; the motion of clouds and volumes of dust; of air borne vehicles, sailing vessels and vehicles under an impelling force—pressure of the wind etc.

junction) that existed between the various constituents of the substrate resulting, finally, in their breakdown into their ultimate particles (*paramāṇus*). When thus, loosened their attachments, *paramāṇus*, in contact with another group of *tejas*, results in the destruction of their original *guṇas* or qualities. Subsequently, again, similar fresh contact with *tejas* is stated to take place, which results in the production of fresh *guṇas* in the place of old ones. These latter *guṇas* are known as *pākaja* (due to the influence of chemical action).

It would, in other words, appear that a single contact with *tejas*, which destroys the previous *guṇas* or qualities of the substrate, may not produce fresh *guṇas* or qualities in the place of old ones. By implication, the destruction of the old *guṇas* and the emergence of new ones, depend upon several contacts, at distinctive periods of time, between the substrate and *tejas*. This interesting description of *pāka* or chemical action, has been described under two headings, viz., *pīlu* and *pīṭhara pākas*.

Pīlupākas

The term *pīlu* refers to *paramāṇu* (atom) and the term *pāka* to the transformation or change brought about in the relationship between *pīlus*, under the influence of *tejas* (light and heat). According to *Viśeṣikas Pīlus*, (*paramāṇus*) combine, separate and recombine, under the influence of *tejas*—heat and light.¹ In this view, the difference observed between one substance and another or generally speaking, between all substances, as regards their colour, consistency (roughness and smoothness etc.) is due to *pākabheda* (difference in chemical actions). According to Vācaspati Miśra, it is *agni* and *agni* alone that can cause transformation in respect of colour, tastes, smell or physical characteristic of *paramāṇus*. This depends, in his view, on (a) the nature of the constituent substance in contact, (b) intensity or degree of *agni*, described in terms of *khara*, *mṛdu* and *madhya*, and the species of *tejas*

1. Endothermic and exothermic reactions.

anu that impinge on *anus* or atoms and the nature of the impact (*vilakṣaṇa-tejas-saṁyoga*).¹

Stated in brief, the *Vaiśeṣika* school holds that "decomposition of *piṭharas* into *pīlus*, which compose them; the transformation of the qualities of *paramāṇus*, and finally their recombination, all take place under the influence of *tejas*.²

Various are the examples given to illustrate the *pākas* substances undergo under the influence of *agni*. The ripening of an unripe mango under the influence of solar heat resulting in the transformation or change in the colour, taste, smell etc., of the latter is one such example.

These changes are considered to be brought about by subtle (*sūkṣma*) chemical action resulting in the decomposition and recombination of molecules (*piṭharas*) under the influence of heat supplied from outside (*vijātiya*³ or *vilakṣaṇa-tejaḥ-saṁyoga*). Implicit in this example, is the idea of the presence in the molecules of the mango of *sajātiya tejas* which when activated by *vijātiya tejas* leads to radical changes in the physical and chemical characteristics of the fruit. This example has special reference to *pākas* to which organic substances are subjected and it has relevance to the study of *pākādī karma* to which *bhāra dravyas* are also subjected, likewise, in the living body.⁴

1. न ब्रूमोऽग्निर्संयोगात् एकस्मात् रूपादय इति, अपि तु पूर्वरूपादिविशेषापेक्षात्। यद् द्रव्यं पच्यते अग्निसंयोगेन तस्य ये पूर्वरूपादयस्तेषां वः स्वगतो विशेषस्त-
मपेक्षमाणः अग्निसंयोगः उत्तरान् रूपादीन् विशिष्टानारमन्ते। Quoted by
B. N. Seal in the *Positive Sciences of Ancient Hindus*, p. 105.

2. अस्माकमभेदे अपि उपादानस्य पिठरस्य औष्ण्यापराव्यस्य च वह्निः संयोगस्य
पूर्वरूपादिप्रध्वंसानां कारणानां भेदात् भिन्नजातीयाः जायन्ते गन्धरूपरसस्पर्शाः
इति सिद्धान्तः। (*Ibid*).

3. The *Vijātiya-tejaḥ-saṁyoga* referred to here is reminiscent of the optimum temperature required for enzyme action and oxygen. The obvious fact is that, the heat mentioned is atmospheric in nature. This represents energy, the origin of which is the Sun.

4. Umeśa Miśra has quoted *Vyomāvatī*, a commentary on *Padārtha-dharmasaṁgraha*, also known as *Prakāśapāda bhāṣya* (*Vizianagaram Sanskrit Edition*), as stating that these *pākas* include

The example of *pakas* which take place during the baking of a clay pot in a kiln usually cited by *Nyāyavaiśeṣikas* are of interest and will be instructive. In the process of the baking of a raw clay-pot by a potter under the condition of temperature that obtains in the potter's kiln, quick succession of changes are considered to take place in the material of the pot in respect of its colour, density and consistency etc., similar to changes that take place during the process of cooking of food. The *vaiśeṣikas* interpret and explain the successive phases of transformation and changes, as due to the decomposition of the constituent molecules of the material pot into their component *aṇus* (atoms) and the subsequent recomposition of the latter under altered spatial relationship—different from their original configuration—in the material of the raw-clay-pot which was subjected to the action of *agni*. The entire process of change in the molecular and atomic configuration is stated to occur in these consecutive steps viz.,

- (i) the decomposition of the material of the pot into its molecules, in the first stage;
- (ii) the decomposition of the molecules into their constituent *aṇus*, in the second stage;
- (iii) the recombination of the *aṇus*, in new relationship and altered spatial alignment, into molecules of two *aṇus* (*dvaṇukas*), three *aṇus* (*tryaṇukas*) and soforth.

Thus, the spatial relationship that originally existed between one *aṇu* and another, in the material of the unbaked clay-pot is now seen to be completely changed resulting in the

even human body, but generally, "no example is taken from these cases, for the simple reason that if anyone comes to know of the chemical action, taking place in him, he may be disgusted with his own body and his interest may cease towards it."

(Author's comment : This peculiar attitude was perhaps the *cause-belle* for the neglect and avoidance of any mention of the details of *pākādi karmas*, referred to in the latter Āyurvedic commentaries such as those by Cakrapāṇi Datta, Ḍalbhāṇa, Aruṇa Datta, Hemādri and soforth).

exhibition, by the finished pot of new properties as regards its colour, density, consistency etc.

The transformation or changes referred to, in the foregoing paragraphs, are stated to occur in nine *kṣaṇas*—each *kṣaṇa* being equal to 2/45th of a second.¹ The quaint way in which *Vaiśeṣikas* have described these nine steps, corresponding to nine *kṣaṇas*, mentioned above, are as follows—"It takes nine *kṣaṇas* or moments for the completion of the consummation of the change from the unbaked to baked state of the clay-pot. In the first moment (*kṣaṇa*) the *dvyanukas* are destroyed. In the second *kṣaṇa*, the original black colour of the unbaked clay-pot is destroyed. In the third *kṣaṇa*, a different colour—red—is generated under the influence of heat and light. In the fourth *kṣaṇa*, the *paramāṇus* combine to form the new substance. In the fifth *kṣaṇa*, the *paramāṇus* separate themselves from their old position i.e. from their former place. In the sixth *kṣaṇa*, they separate themselves again. In the seventh *kṣaṇa* they combine with other *paramāṇus*. In the eighth *kṣaṇa*, they again align themselves as molecules of two *paramāṇus* i.e. *dvyanukas*. In the ninth *kṣaṇa*, the specific or characteristic properties of the *paramāṇus* such as colour, touch etc., manifest in the constituent *dvyanukas* of the material of the new (now) fully baked pot.² Thus, in nine moments or *kṣaṇas*, the soft, dark, unbaked clay pot is transformed into the hard and red baked pot. The concept of *pilu-pāka*³ may be aptly described as chemical change.

1. A *kṣaṇa* of *Nyāya-vaiśeṣika* is equal to 2/45th of a second. (Fundamental principles of Āyurveda by Dr. C. Dwarakanath : Part I, p. 40).
2. *Kaṇḍarahasya* by Śaṅkara Miśra : Chawkhamba Benaras Edition : p. 61.
3. अत्र परमाणुष्वेव पाकः न षण्णुकादौ । आमपाकनिश्चिसेवटे परमाणुषु रूपान्तरोत्पत्तौ द्यामघटनाशे पुनः षण्णुकादिक्रमेण रक्तघटोत्पत्तिः । तत्र परमाणवः समवायिकारणम्, तेजःसंयोगोऽसमवायिकारणम्, अदृष्टादिकं निमित्तकारणम् । षण्णुकादिरूपे कारणरूपमसमवायिकारणमिति पीलुपाकवादिनो वैशेषिकाः ।

(*Dīpikā on Tarkasamgraha*).

Piṭhara pāka—

Piṭhara pāka means “the union of cause and effect (*kāraṇa* and *kārya*) i.e. atoms by means of heat.¹ The *Naiyāyikas* hold that the *piṭharas* or molecules or larger aggregates of them, assume new characteristics, under the influence of heat, without involving the break down of the molecules or change in the characteristic of the *paramāṇus*.² That is to say, *piṭharas* (the material of the clay pot is stated to be composed of numerous *piṭharas*), undergo transformation under thermal influence. Consequential changes in them relate merely to a physical change of the molecules concerned. In this view, the *pāka* does not imply any radical change of the *aṇus* which compose the *piṭharas*. A *piṭhara* is stated to consist of two or more *aṇus* (atoms). The change in colour from black to red, assert the *Naiyāyikas* is really a change in the colour of *piṭharas*. This view resembles modern description of physical change.

Thus, according to *Nyāya-vaiśeṣikas*, all changes at the macroscopic and microscopic, and organic and inorganic levels, are due to *pākas*, i.e. chemical actions, brought about under the influence of *tejas* (*agni*). *Agni* in this view, is the power which is responsible for bringing about the break down and synthesis of substances. The action of *agni* is correlated to and is implicit in the motion or *karma*³ performed

1. Sanskrit-English Dictionary : Monier Williams page 625.

2. पूर्ववदनाशं विनैव अवयविनि अवयवेषु परमाणुपर्यन्तेषु

च शुष्मपद्रूपान्तरौपत्तिमिति पिठरपाकवादिनो नैयायिकाः ॥

(*Dīpikā on Tarkasaṃgraha*).

3. The *karma* or motion, described by this system under the influence of *tejas*—is reminiscent in some respects of modern views on thermal disorder, according to which, “the irregular motion of molecules of any material substance is known as heat or thermal motion, for the simple reason that these motions are responsible for the production of heat. Such molecular motions, visible in the slanting beams of the sun falling into a dark room through a chink or hole, or the molecules which make up water or any other substance is known as Brownian motion. These molecules oscillate back and from, colliding with one

by bodies as will be evident from the observations of Caraka regarding *karma* viz., "action which is the cause of *samyoga* (conjunction) and *vibhāga* (disjunction) is implicit in the substance or *dravya*. Action is the performance of what is to be done. It depends on nothing else. ¹

Summing up : The concept of *tejas* (*agni*), is implicit in the *rajas* of *Sāṃkhya* system, *Rajas*, according to this system of scientific thought, stands for kinetic energy of the universe. All events—at the galactic, molar, molecular and atomic levels (including the physiological and psychological)—are governed by the important and vital role played by *rajas*. The doctrine of *rajas* of *Sāṃkhya* system represents one of the fundamental aspects of a pure science.

The *Nyāya-vaiśeṣika* system of scientific thought, which deals with *tejas* (*agni*), *karma* (motion) and *pākas* (chemical

another at random. Greater the agitation, the higher is the temperature. When a liquid freezes, molecular motion is reduced sharply. At a temperature of -273°C or -459°F , thermal agitation of matter completely ceases and all its molecules come to rest. This is apparently the lowest temperature—known as absolute zero. Still lower temperatures do not seem to exist because, there is no motion lower than the apparent rest. Near the point of absolute zero temperature, molecules of any substance have little energy, and the cohesive forces which act upon them cement them together into a solid block. In this state, the molecules can only quiver slightly in their frozen state. When the temperature is raised, the quivering becomes more intense and at certain stage, molecules obtain freedom for motion and they slide by one another, and the rigid frozen substance becomes fluid. The temperature at which melting occurs, depends upon the strength of the cohesive forces which act upon the molecules. More thermal agitation breaks up the cohesion and the molecules become loosened completely and move up e.g. the evaporation of water. Thus, for every motion, *agni* is essential and this motion, in its turn produces *agni*.

1. संयोगे च विभागे च कारणं द्रव्यमाश्रितम् ।

कर्तव्यस्य क्रिया कर्म कर्म नान्यदपेक्षते ॥ Caraka : Sūtra 1 : 52.

actions) on the other hand would appear to represent an applied aspect of science.

From the *Upaniṣadic* point of view, *agni* and *soma*, known also, as *anna* and *prāṇa* respectively, represent two aspects of the universe.¹ The term *soma* or *anna* has been interpreted as referring to the things of the universe, which are utilised for existence.² It has been stated that *soma* or *anna* represents the matter-stuff of the universe, which allows itself to be cooked (decomposed or disintegrated). That which cooks *soma* or *anna* is stated to be *agni*—also known as *prāṇa*. *Soma* and *agni* are stated to be inseparable, that is to say, they are bound together inseparably—‘मिथुनमुत्पादयते’. This inseparable relationship of the two has been described as ‘*rayi*’ (रयि).

In modern scientific thought, matter and energy correspond to *soma* and *agni*. Energy and matter, according to modern views, are not separable from one another; they are interchangeable. All things of the universe represent two aspects of nature i.e. matter and energy, which are in a state of *mithuna*. In other words, they represent the obverse and reverse of the same coin. It may be added that the view summarized above as regards *agni* and *soma* are also shared by *Suśruta*.³ The only point which need an emphasis, here, is the fact that, *agni* is the kinetic factor at all levels of nature.

1. (a) अग्नीषोमात्मकं जगत् । *Śatapatha Brāhmaṇa* : Kāṇḍa 6 :

Brāhmaṇa 1.

(b) अग्नीषोमीयत्वाज्जगतः । *Suśruta* : *Sūtra* 40 : 5.

2. अयते अग्निं च भूतानि तस्मादन्नं तदुच्यते । *Taittirīya Upaniṣad* : 2, 2, 1.

3. The reference to views held by *Suśruta* on this issue has been mentioned by *Vāgbhaṭa* both in his *Saṁgraha* and *Hṛdaya*.

Suśruta's reference runs as follows :

(a) अग्नीषोमीयत्वाज्जगतः *Suśruta* : *Sūtra* 40 : 5.

(b) नानात्मकमपि द्रव्यमग्नीषोमो महाबलौ ।

व्यक्ताव्यक्तं जगदिव नातिक्रामति जातुचित् ॥

Aṣṭāṅgasaṁgraha : *Sūtra* : 17 and *Aṣṭāṅgahṛdaya* : *Sūtra* 9 : 17.

SECTION III

CONCEPT OF AGNI IN ĀYURVEDA

Agni in *Āyurveda*, is reflected in the concept of *pitta* of this system.¹ The term *pitta* is derived from the root 'tap'—to heat or 'to burn'.² This term is seen to have three meanings viz., तप ऐश्वर्ये, तप दाहे and तप सन्तापे.³ (a) *tap saṁtāpe* refers to the generation of heat;⁴ (b) *tap dāhe* relates to the act of burning of the nutrition consumed⁵ and (c) *tap aiśvarya* refers to that factor which is responsible to make one achieve the eight kinds of benefits.⁶ These references are obtained from the Bhattoji's *Siddhāntakaumudī* and would therefore furnish the *vyākaraṇa* version of the term *pitta*. From the point of view of *Āyurveda*, *pitta* has been described as *agni* (fire), since it performs fire-like actions i.e. *pāka*, which refers to *pācana* (digestion); *dahana* (burning, combustion or oxidation) including *bhinna saṁghāta* (splitting); *tapana* (heat production), *pariṇamana*⁷ (conversion), *parāvṛtti*⁸ (transformation), *prakāśana* (illumination), *rañjana* or *varṇakara* (colouration) and *prabhākara* (to cause lustre).⁹

1. अग्निरेव शरीरे पित्तान्तर्गतः..... । *Caraka : Sūtra* 12 : 11.

2. तप संतापे... । *Suśruta : Sūtra* 21 : 5.

3. तप ऐश्वर्ये —*dīrghādi gaṇa*—(तप्यते)
तप दाहे —*aurādi gaṇa*—(तापयति, तपयति)
तप संतापे —*bhēdādi gaṇa*—(तपति) *Siddhāntakaumudī*.

4. तपति कम्पाणमुत्पादयतीति पित्तम् ।

5. तापयति दहति भुक्तमाहारजातं इति पित्तम् ।

6. तप्यतेऽष्टविधमार्गमादिकमिति पित्तम् ।

7. पाकः परिणतौ (*Medhāt*).

8. पाकः परावृत्तिः (*Ibid*).

9. Some of the functions ascribed to *pitta* such as *pācana* including *bhinna-saṁghāta* (splitting), *dahana* (burning, combustion, oxidation), *tapana* (heat production), *pariṇamana* (conversion) and *parāvṛtti* etc. are reminiscent of some of the chemical reactions described by modern chemistry and biochemistry. They

In a general sense, the term *kāya* or body itself has been equated to *agni*.¹ Caraka has recorded Marici as having stated that "it is only *agni*, which is located in *pitta*, that gives rise to beneficial or adverse consequences according as it is in normal or abnormal state of functioning."² Clarifying the implication of the term *pittāntargata*, used in above description, Cakrapāṇi has observed that, this term does not mean that the *pitta* of the body is flaming fire and it only refers to the phenomenon of heat which is associated with fire.³ By implication, heat is seen to be associated with the function of *pitta*. The references made by *Medinī* and *Amarakoṣa* to the functions of *pitta*, have a direct bearing on the *pāka karmas* to which *āhāradravyas* are subjected, resulting in their *pariṇāma* or transformation. The implications of these two aspects of *pitta-vyūpāra*, are the digestion of food and its transformation into various functional and structural factors of the body.

The question if *pitta* and *agni* are identical or different has been raised and answered by *Suśruta* in the 21st chapter of the *sūtrasthāna* of his *Saṁhitā*. The passage under reference runs as follows—"It may now be asked, if *pitta* is the same as *agni* or it is something different. This question may be answered by stating that *pitta* is the same as *agni*, since it performs *dahana*⁴ (burning, combustion or oxidation) *pacana* (digestion) and similar actions performed by fire, hence *pitta*

are combination reaction, substitution reaction, addition reaction, decomposition reaction, dissociation reaction, displacement reaction, hydrolysis reaction, oxidative reaction and reduction reaction. These reactions are usually mediated by catalysts. In bio-chemical reactions, organic catalysts, viz., enzymes accelerate these reactions.

1. आठरः प्राणिनामग्निः काय इत्यभिधीयते ।

यस्तं चिकित्सेत्सीदन्तं स वै कायचिकित्सकः ॥ Bhoja : Quoted by Śivādāsa Sena in his Commentary on Caraka : Sūtra 30 : 28.

2. मरीचिरुवाच—अग्निरेव शरीरे पित्तान्तर्गतः कुपितकुपितः शुभाशुभानि करोति । Caraka : Sūtra 12 : 11.

3. पित्तान्तर्गतं इति वचनेन शरीरे ज्वालादियुक्तवह्निर्विधेन पित्तोष्मरूपस्य बह्नेः सद्भावं दर्शयति । Cakrapāṇi on Caraka : Sūtra 12 : 11.

4. दहनं दाहः, पचनं पाकः, आहारादेः । Dālhaṇa on Suśruta : Sūtra 21 : 9.

is known as *antarāgni*.”¹ It may be necessary in this connection to make a passing reference to the controversies as regards the identity of *pitta* and *agni*, referred to by Dhalhana and Cakrapāṇi in their commentaries on the passage from *Suśruta Samhitā*, under reference as well as the *śikā* of Vijayarakṣita in his *Madhukosa vyākhyā* in the chapter on *Kṣudraroga* of *Mādhava Nidāna*. Without going into details of the controversy, which appear to have involved logical subtilities, divorced from objective realities for the settlement of an obvious fact, about which Suśruta himself has been very categorical, it may be stated that Vijayarakṣita has closed the controversy by quoting Bhoja as follows—

पित्तस्य तेजोऽग्न एव पाचकः—तदाह भोजः—

“इदमुच्यते चित्तं ह्येतत् पित्तोष्मा पचतीति यत् ।

मूर्च्छितो रसवीर्याभ्यां समानध्यानसंहितः ॥”

इत्यारभ्य—तस्मात्तेजोमयं पित्तं पित्तोष्मा यः सपक्वमान्

स कायाग्निः स कायोष्मा स पक्वा स च जीवनः ।²

The controversies such as one under mention would appear to have been the fashion of the day—indulgence in logical polemics. Such fashions prevalent in his days should have upset Vācaspati Miśra, so much that he was constrained to observe that “Lovers of *tarka*, often seek to perceive even the perceptible things by inference.”³

However, the various issues raised in this regard by Bhāva Miśra—for and against—are furnished in the Appendix VI.

Neither Caraka and his commentator Cakrapāṇi, nor Suśruta or Vāgbhaṭa, appear to have had any doubt as to the part played by *pitta* in *pacana* and *dahana karmas* with which the production of heat is associated. No doubt, *pitta* is instrumental or better still the factor responsible for bringing about the *saṃghātabheda* of *āhāradravyas*, which serve as

1. तत्र जिज्ञास्यं किं पित्तव्यतिरेकादन्योऽग्निः ? आहोस्वित् पित्तमेवाग्निरिति ? अत्रोच्यते न खलु पित्तव्यतिरेकादन्योऽग्निरुपलभ्यते, आग्नेयत्वात् पित्ते दहनपचनादिष्वभिप्रवर्त्तमानेऽग्निश्चदुपचारः क्रियतेऽन्तराग्निरिति ... ।

Suśruta : Sūtra 21 : 9.

2. Quoted in *Madhukosa on Mādhava Nidāna* : 55 : 32.

3. प्रत्यक्षपरिकल्पितमपि अनुमानेन दुमुत्सन्ते तर्करसिकाः । (Vācaspati Miśra).

indhana and are burnt releasing in the process, *ūṣmā* or heat. Hence, in the final analysis *pitta* is the cause for the production of heat out of the *indhana* (fuel) represented by *āhāra* and therefore *pitta* would appear to be the *nimittakāraṇa*, *indhana* the *upādānakāraṇa*; and *ūṣmā* the *kārya*. The logic and validity of this conclusion will be shown at a latter stage.

A careful study of the existing editions of ancient *Āyurvedic* classics and allied literature shows that *pitta* performs functions similar to those of *agni*. The employment of the agency of physical fire in the cooking of food will serve as an effective illustration.¹ The cooking of food with the help of fire is meant to render the former fit for ingestion and digestion. In other words, the heat employed to cook food substance loosens the molecules of the food material. A parallel to this idea is the employment of the agency of fire (heat) in our chemistry laboratories to bring about the decomposition and disintegration of substances as well as to speed-up chemical reactions. The idea that underlies the fire-like action of *pitta* has to be considered in the light of the foregoing.

Further, a proper appreciation of the physical structure (Composition) of *pitta* described in terms of *pañcabhūtas* may go a long way in the clarification of the *āgneyaguṇa* of this factor. According to Caraka, Suśruta and Vāgbhaṭa, the composition of *pitta* is dominated by *agnibhūta*.² Caraka, as well as Vāgbhaṭa have stated that *pitta* is the fluid (*sāra*) and liquid (*drava*). The latter two qualities of *pitta* have been attributed to the preponderance of *ap-bhūta* also, in the *pañca-*

1. (a) एवं रसमलायाश्चमाशयस्थमधःस्थितः ।

पचत्यग्निर्यथास्थाल्यामोदनायाम्भुतण्डुलम् ॥ Caraka : Cikitsā 15 : 8.

- (b) सन्धुक्षितः समानेन पचत्यामाशयस्थितम् ।

औदर्याग्निर्यथा वाह्यस्थालीस्थं तोयतण्डुलम् ॥ Aṣṭāṅgahṛdaya :

Śārīra 3 : 56.

2. (a) Caraka : Śārīra 7 : 16.

(b) पित्तमाग्नेयम् । Suśruta : Sūtra 42 : 5.

(c) Aṣṭāṅgasamgraha : Sūtra 20.

bhautic composition of this factor.¹ Vāgbhaṭa has clearly stated that *pitta* is *pañcabhautic* and it is *drava* in consistency, in spite of which, it performs actions, similar to *anala* (fire-like), in the course of the process of digestion, largely due to the actualisation of its *tejas* component (discarding its liquidity—*dravatva*). This fact is inferred from the way in which it performs *pākādi karmas*, viz., it digests food, separates *sāra* from *kiṣṭa* of the food. It is because of this, it is known as *pācakapitta*.² By implication, the *pitta* complex would appear to contain as one of its essential constituent elements, a substance possessing *agneya-guṇa* by virtue of which it (the *pitta*) is able to perform various chemical actions, implied in the process of digestion of food.

The concept of *agni* of *Āyurveda*, which refers to the manifold functions ascribed to *pitta* is at once comprehensive. It not only includes chemical agencies responsible for *āhārapacana* in the *koṣṭha* (corresponding to gastro-intestinal digestion), which leads to separation of *sārabhāga* (nutrient fraction) of the *āhāra* (food) from the *kiṣṭabhāga*³ (the indigestible or undigested residue of the food) but also metabolic events—energy, synthesis and maintenance metabolism. In addition, it is seen to comprehend photo and chemo synthetic processes. *Pācakapitta* known variously as *jāṭharāgni*, *koṣṭhāgni*, *antarāgni*, *pācakāgni* and *dehāgni* etc.; while being located in its own place in an area between *amāśaya* and *pakvāśaya*,⁴ directly participates in the digestion of food and at the same time, lends support to and augments the functions of the remaining *pittas*, present elsewhere in the body.⁵ The reference here, obviously relates to the remaining *pittas* viz., *rañjaka*, *sādhaka*,

1.रसकधिरवसाकफपित्तमूत्रस्वेदादि तदाप्यम् ।
.....यत् पित्तमूत्रमा च यो या च माः शरीरे तत्सर्वमाग्नेयम् । *Caraka : Śarīra* 7 : 16.
2. पञ्चभूतात्मकस्वेऽपि यत्तैजसगुणोदयात् ।
त्यक्तद्रवत्वं पाकादि कर्मणानलशब्दिनम् ॥ *Aṣṭāṅgahṛdaya : Sūtra* 12 : 10.
4. पचत्यन्नं विभजते सारकिष्ठौ पृथक्तया । *Aṣṭāṅgahṛdaya : Sūtra* 12 : 11.
3. तत्र पक्वामाशयमध्यगम्... । (*Ibid* 10).
5. तत्रैवमेव पित्तानां शेषाणामप्यनुग्रहम् ।
करोति बलदानेन पाचकं नाम तत्स्मृतम् ॥ *Aṣṭāṅgahṛdaya : Sūtra* 12 : 10.

ālocaka and *bhrājaka*. It is held that the *pācaka* *pitta* contributes moities of itself to the seven *dhātvaṅis*, and supports and augments the function of the latter.¹

It would be seen from the foregoing that the *Āyurvedic* concept of *agni* includes, not only five kinds of *pittas* but also, the *dhātvaṅis* and *bhūtāṅis*. It is clear from the classical *Āyurvedic* texts that the enumeration of the number of *agnis* (which include *pitta*) varies from author to author. According to *Caraka Saṁhitā*, read together with its main commentary by Cakrapāṇi Datta, the number of *agnis* enumerated are over 13 as shown below—

antaragni 1, *bhūtāṅni* 5, *dhātvaṅni* 7.²

On the other hand, *Suśruta* is seen to have described only five *agnis* viz. *Pācakaṅni*, *rañjakāṅni*, *ālocakāṅni*, *sādhakāṅni* and *bhrājakaṅni*.³ There is however an indirect reference in *Suśruta Saṁhitā* to five *bhūtāṅis*, in the brief description made to the transformation, which foodstuffs undergo in the organism.⁴ When these five *agnis* are taken into consideration, the total number of *agnis* according to *Suśruta* would be ten. *Vāgbhaṭa* is seen to have reckoned

5 *pittas*
5 *bhūtāṅis*
7 *dhātvaṅis*
3 *doṣāṅis*
3 *malāṅis*

in all twentythree *agnis*.⁵ Of the more recent authorities, *Śārṅgadharma* is seen to have recognised five *pittas* only.⁶ On the other hand, *Bhāva Miśra* is seen to have followed *Caraka* and *Vāgbhaṭa*.⁷

1. स्वस्थानस्थस्य कायाभ्येरंशाः शानुषु संस्थिताः ।

तेषां सादातिदीप्तिभ्यां शानुषुद्विषयोद्भवम् ॥ *Aṅgahārdaya* : *Sūtra* 11 : 34.

2. *Caraka* : *Cikitsā* 15 : 38.

3. *Suśruta* : *Sūtra* 21 : 10.

4. पञ्चभूतात्मके देहे आहारः पाञ्चभौतिकः ।

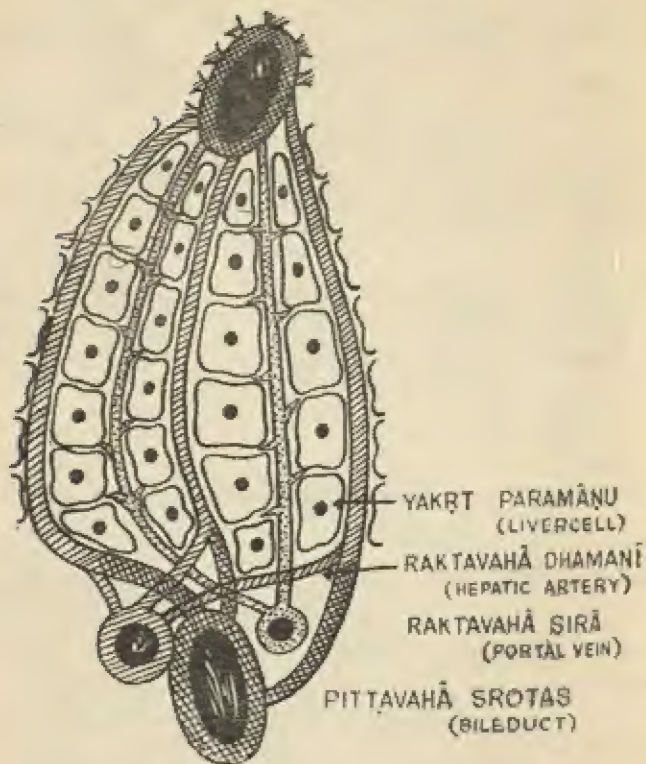
विपक्वः पञ्चषा सम्यक् स्वान् गुणानभिबर्धयेत् ॥ *Suśruta* : *Sūtra* 46 : 526.

5. *Aṅgahārdaya* : *Sūtra* 12, and *Śārira* 3.

6. *Śārṅgadharma*; *Pūrvakhaṇḍa* : 6th. Chapter.

7. *Bhāva* *Prakāśa* : *Prathamakhaṇḍa* : *Śārira* 3.

I
PITTAFORMATION IN YAKṚT





The general physical characteristics and properties of *pitta* or *agni*, as could be gathered from the available editions of the works of Caraka,¹ Suśruta,² Kāśyapa,³ Vāgbhaṭa,⁴ Śaraṅgadharā⁵ and Bhāva-Miśra⁶ are furnished in the table below :

Colour	Consistency Density	Taste	Smell	Other properties
<i>Śuklārūṇa</i> <i>varja</i> (Colours other than white and red).	<i>Sara</i> (fluid) <i>Laghu</i> <i>Drava</i> (liquid) (light)	<i>Katu</i> (acrid) <i>Amla</i> (sour) normal	<i>Visra</i> fleshy <i>Vai- gandhya</i> (un- pleasant smell)	<i>Sattva</i> <i>Uṣṇa</i> (hot) <i>Tikṣṇa</i> (keen sharp or peni- trating or in- tense or quick in action
<i>Pāṇḍu</i> <i>vīvarjita</i> (all colours other than <i>Pāṇḍu</i>)	<i>lṣat</i> or <i>anatisneha</i> (slightly viscous)	and when <i>vidagdha</i> <i>Tikta</i> (bitter)	<i>Pūti- gandha</i> (putrid smell)	
<i>Nila</i> and <i>Pita</i> (Blue and yellow)				

A careful appraisal of the physical characteristics and properties tabulated above, *vis-a-vis pitta* to which they may refer

1. (a) सस्नेहमुष्णं तीक्ष्णं च द्रवमम्लं सरं कटु ।

विपरीतगुणैः पित्तं द्रव्यैराशु प्रशाम्यति ॥ *Caraka : Sūtra 1 : 60.*

- (b) औष्ण्यं तैक्ष्ण्यं द्रवत्वमनतिस्नेहो वर्णो च शुक्लारुणवर्जो, गन्धश्च विस्त्रः, रसो च कटुकाम्लौ सरत्वं च पित्तस्यात्मरूपाणि ।

Caraka : Sūtra 20 : 15.

2. पित्तं तीक्ष्णं द्रवं पृति नीलं पीतं तथैव च ।

उष्णं कटुरसं चैव विदग्धं चाम्लमेव च ॥ *Suśruta : Sūtra 21 : 11.*

3. लाघवं तैक्ष्ण्यमौष्ण्यं च वर्णं शुक्लारुणादृते ।

वैगन्ध्यं कटुकाम्लत्वमीपस्नेहश्च पित्तजाः ॥ *Kāśyapa.*

4. पित्तं सस्नेहतीक्ष्णोष्णं लघुविस्त्रं सरं द्रवम् । *Aṣṭāṅgahṛdaya : Sūtra 1 : 11.*

5. पित्तमुष्णं द्रवं पीतं नीलं सत्त्वगुणोत्तरम् ।

कटुतिक्तारसं शैवं विदग्धं चाम्लतां भजेत् ॥

Śaraṅgadharā : Pūroakhaṇḍa : 5 : 29.

6. पित्तमुष्णं द्रवं पीतं नीलं सत्त्वगुणोत्तरम् ।

सरं कटुलघुविस्त्रं तीक्ष्णमम्लं तु पाकतः ॥

Bhāva-Miśra : Pūroakhaṇḍa : 3 : 120.

shows that they are very general in their outlook and may refer in particular to the *pitta* known in modern times as hepatic-bile. However, qualities such as *sara*, *drava*, *uṣṇa* and *tikṣṇa* may pertain to all the *pittas* or *agnis* of the body and, in special, to *pācaka pitta* (complex). As regards the colour, consistency, taste and smell ascribed to *pitta*, such as *śukla-ruṣavarja* or *pāṇḍuvivarjita*; *anadhika sneha*; *kaṣu* and *amla*; *visragandha*, *vaigandhya* and *plūtigandha*; *nīla* and *pitta*, it would appear that they have a direct bearing on the more familiar *bile* secreted by the *yakṛt* which as will be shown later may form part of the *acchapitta* (-complex). This view finds support from the description of *pitta* as the *mala* of *rakta* (भस्मजः पित्तम्)¹ and also, the reference made by Caraka² and Vāgbhaṭa³ to *pitta* as the *vikṛti* of *rakta*—both because of its intimate co-existence with and capacity to impair the integrity of *rakta*; also because of the fact that, *pitta* and *rakta* possess nearly identical smell and colour; in addition, the location of these two factors are *yakṛt* (liver) and *plthā* (spleen). This view finds direct corroboration from modern physiological views as regards blood-bile relationship which can be summed up as follows—"The pigment of bile-bilirubin and biliverdin are the essential constituents of the haemolobin-complex of the erythrocytes. From this point of view, it may be stated that *rakta* is the seat of *pitta*. These two bile pigments are also the wasteproducts or the *malas* of *rakta*. *Rakta* and *pitta* are stated to have identical colour. The truth of this statement will become evident by taking into consideration the fact that, though bright red in colour, if left undisturbed, the blood separates into two parts—the lower,

1. Caraka : Cikitsā 15 : 18.

2. संयोगाद् दूषणात्तु सामान्याद्वन्धवर्णयोः ।

रक्तस्य पित्तमाख्यातं रक्तपित्तं मनीषिभिः ॥

प्लीहानं च यकृच्चैव तदधिष्ठाय जायते (वर्तते) ।

स्रोतांसि रक्तवाहीनि तन्मूलानि हि देहिनाम् ॥ Caraka : Cikitsā 4 : 9-10.

3. पित्तं रक्तस्य विकृतेः संसर्गाद् दूषणादपि ।

गन्धवर्णानुवृत्तेश्च रक्तेन व्यपदिश्यते ॥

प्रमवत्यसृजः स्थानात्प्लीहतो यकृतश्च तत् ।

contains the cell and is opaque and red, while the upper part is a clear yellow liquid—the plasma. Under the microscope, an enormous number of pale yellow discs—the red blood corpuscles—floating in a colourless clear fluid, can be seen. Although yellow, when seen individually, the erythrocytes appear to be red in bulk. The colour of the hepatic-bile is golden-yellow which is largely due to its pigments—bilirubin and biliverdin. When set free into the blood, the bilirubin contributes to the normal colour of the plasma. Both bile and blood have nearly the same characteristic fleshy smell. In addition, both blood and bile are intimately connected with the liver and spleen.

Therefore, the correlation of *pitta* and *rakta*, referred to in *Āyurvedic* classics, may represent the summation of the normal relationship that exists between blood and some of the important constituents of bile. This can be seen from the fact, that the formation of bile consists in the removal of bilirubin from blood; its conversion in the liver; its excretion in the bile canaliculi, the reabsorption of it from the intestine in the form of the colourless compound—the stercobilinogen, which latter is utilised by liver cells for the production of fresh haemoglobin. The role of spleen as regards the disposal of the red blood corpuscle can be seen from the fact, that the macrophages present in it, convert the fragmented dust of degenerated red cell into bilirubin, which is transported to the liver where it is utilised for purposes mentioned above.¹

1. The breakdown and rebuilding of the important constituents of the blood corpuscles, which are being continuously formed and destroyed by the reticulo-endothelial cells, proceed throughout the life of the organism. Erythrocytes, to a large extent, undergo destruction in the blood stream due to stresses and strains to which they are subjected during their passage through blood vessels. At last, becoming aged, they are not able to withstand different kinds of stresses and strains to which they are exposed—they undergo fragmentation. Fragments of different shapes and varying in size, from that of a half or quarter

Additional support to this view is derived from the reference made by all the ancient authorities of *Āyurveda* to the symptomatology of *pittavṛddhi*, viz., yellowness of urine, faeces, eyes and skin, increased appetite, thirst, burning sensation in the body and insomnia.¹ These symptoms, especially, yellow colour of the urine, faeces, skin and eyes are stated, by modern physiology, to be due to the circulation, in excess, of the pigment bilirubin a condition described as bilirubinemia. It is significant to note that Cakrapāṇi Datta in his commentary on Caraka's description of *śākhaśrita kamalā* has observed that, the non-excretion of *pitta* (which imparts to faeces

of the whole cell to mere dust-like remnants containing haemoglobin (haemoconia) are to be found circulating in the blood, spleen and to a lesser extent, occasionally in other tissues. From the determination of bile pigment excretion, it has been estimated that in health between seven to ten millions of red cells are destroyed in this way every second. Of course, the same number must be formed afresh by the blood forming tissues. The loss of haemoglobin is between 16 to 24 g. daily. The haemoglobin dust is changed into organic iron and pigment bilirubin. The bilirubin is transported to the liver through the medium of plasma and is slightly changed, during the passage into bile. Part of the bile is excreted into the intestine through the bile duct and in the bowel bilirubin is changed into colourless stercobilinogen and stercobilin, which latter gives to the faeces its natural dark colour. The stercobilinogen is reabsorbed into the portal blood-stream and is utilised by the liver for the production of new haemoglobin. Following the bilirubin in the liver it is seen that it is broken down by *Kupffer's* cells and gets converted into bile-pigment-biliverdin which when reduced becomes bilirubin. The protein-free portion is set free into blood, contributing to the yellow tint of the plasma.

(Based on physiological Basis of Medical Practice by Best and Taylor and Human Physiology by Winton and Bayless).

1. पीतविष्णुनैऋतवक्त्रुत्तृद्धाहाल्पनिद्रता । *Āyānagahṛdaya : Sūtra* 11 : 7.

its characteristic colour—*malurāṅjaka*) into *koṣṭha*, is responsible for *śveta varcas* or whitishness of *pūṛiṣa*, in this condition.¹

The explanation of *śvetavarcas* (corresponding to the whitishness of faeces) in *śakhaśrita kāmala* (corresponding to obstructive jaundice) finds support from the modern biochemical findings and they focus attention to the substance the non-excretion of which into the intestine (corresponding to the *koṣṭha* of *Āyurveda*) causes clay-coloured stool (corresponding to *tlapiṣṭanibha varcas*). According to modern biochemistry, "when bile is totally excluded from the intestinal tract, as a result of severe liver-dysfunction, extra-hepatic biliary obstruction or biliary fistula, lipid absorption is more critical. As a result of total lipid content in faeces in a cholic animal is elevated largely owing to an abundance of salt of fatty acids. The presence of these soaps, chiefly insoluble calcium salts, together with the absence of bile-pigments, result in the characteristic clay-coloured stools seen in biliary obstruction."²

It would seem, that the *pitta* to which the physical characteristics and qualities, under discussion are attributed may refer to liver-bile and not others.

An appraisal of the functions, ascribed to *pitta* would lend support to the view expressed above. According to Caraka, who has recorded Marīci, in his *Saṁhitā*, as having stated that "Digestion or indigestion, visual perception or impairment of it; the normal or abnormal body temperature; the normal or abnormal colour of the body; courage or fear; anger or cheerfulness; lucidity or confusion of mind and such opposite traits are the functions of *pitta*."³ According to Suśruta, *pitta*

1. वफसंमुच्छितो वायुः स्थानात्पित्तं श्लिषेद्बली ।
हारिद्रनेत्रमृशस्वः श्वेतवर्चास्तदा मरः ॥ (Caraka : Cikitsā, 16 : 126)
श्वेतवर्चा इति कोष्ठस्थपित्तस्य मलरञ्जकस्य
वर्णिनिर्गमाद्भेदेन हलेष्मणा श्वेतवर्चा भवति ॥ (Cakrapāṇi on the above).
2. Abraham White et al : Principles of Biochemistry : 1954 Edn. page 458.
3. मरीचिरुवाच :—अक्षरेव शरीरे पित्तान्तर्गतः कुपितकुपितः शुभाशुभानि करोति
तथा पक्तिमपक्तिं दर्शनमदर्शनं मानामात्रत्वमूष्मणः प्रकृतिविकृतिवर्णौ शौर्यं
भयं क्रोधं हर्षं मोहपसादमित्येवमादीनि चापराणि द्रव्यानि इति ।
(Caraka : Sūtra 12 : 11.)

in its five varieties, imparts colour (*rāgakṛt*), promotes digestion and metabolism (*paktikṛt*) forms *ojas* (*ojakṛt*) promotes vision (*tejaskṛt*), causes intellect (*medhākṛt*) and body-heat (*ūṣmakṛt*).¹ In the opinion of Vāgbhaṭa *pitta* is responsible for the causation of body-heat; it contributes to vision, confers *prabhā* (lustre of the body) and is responsible for *buddhi* and *medhā*, courage or valour and *mārdava* or softness of the body.²

The functions attributed to *pitta*, in general, are summed up in the table below :—

Somatic or <i>Sārira</i>		Psychological or <i>Mānasika</i>	
Prākṛta or physiological	Vaikṛta or abnormal	Prākṛta or physiological	Vaikṛta or pathological
production of hunger, appetite, thirst and digestion	Impairment of hunger, appetite, thirst and digestion	courage	fear-complex
Metabolism	Abnormal or subnormal states of metabolism	cheerfulness	Anger, rage
visual perception	Impairment of visual perception	lucidity	confusion
Haemopoiesis or the colouration of <i>rasa</i> in the process of <i>rakta</i> formation.	Impairment of the formation of <i>rakta</i>	Intellection and intelligence.	Idiocy
production of body-heat and temperature	Abnormal or subnormal temperature.		
The colour and lustre of the skin health	Impairment of skin health colour pigmentation		
The formation of <i>ojas</i>	Impairment of the formation of <i>ojas</i> .		

1. रागपक्तयोऽस्तेजोमेधोष्मकृतं पित्तं पश्चात् प्रविभक्तमधिकर्मणा अनुग्रहं करोति ।
(*Suśruta: Sūtra* 15 : 4.)
2.पित्तं पक्त्युपदर्शनैः । क्षुत्तृश्चिपमामेवाधी शीयंतनुमार्दवैः ।
(*Aṣṭāṅgahṛdaya: Sūtra* 11 : 2-3).

It is obvious that, of the various functions attributed to *pitta*, only a part of it namely, the production of hunger including appetite (*kṣut*), thirst (*tṛṣṇā*), digestion (*pākti*) may relate to the physical characteristics and qualities, now under discussion, which have been described in the *samhitā granthas*. The discussion of the concerned *pitta* is really a study of *pācaka pitta* as a whole and *accha pitta* in part.

Both Suśruta¹ and Vāgbhaṭa² have stated that *pācaka pitta* obtains in an area between the *pakvāśaya* and *āmāśaya*; whereas Caraka³ has stated in very clear terms that *acchapitta* is secreted as the food which has acquired *amlabhāva* traverses from the *āmāśaya* to the next lower portion of the *koṣṭha*. It is of importance to note that none of these authorities have made any mention of the colour, consistency, taste etc. of either *pācaka pitta* or *accha pitta*.

Likewise, both Suśruta and Vāgbhaṭa have indicated that the organ known as *grahāṇī* is located between *pakvāśaya* and *āmāśaya* and that (a) the relation that exists between *agni* and *grahāṇī* is reciprocal, i. e., *agni* supports the function of *grahāṇī* and *grahāṇī* supports the function of *agni*; ⁴ (b) *grahāṇī* is also spoken of as *pittadharā kalā*⁵ and it holds the ingested food for the duration of its digestion, before the *kṛṣṭa* or undigested food residue is propelled into the *pakvāśaya*.⁶ Vāgbhaṭa has emphasized the latter point and described it as '*grahāṇī grahāṇī*.'⁷ Suśruta has defined *kalā* as '*dhātuvāśayāntaramāryādā*';⁸ meaning '*kalā*' is the structure which intervenes

1. तत्रादृष्टहेतुकेन विशेषेण पक्वामाशयमध्यस्थं पित्तं चतुर्विधमन्नपानं पचति ।

(Suśruta : Sūtra 21 : 10).

2. तत्र पक्वामाशयमध्यगम् । (*Aṣṭāṅgahṛdaya* : Sūtra 12 : 10).

3. परंतु पच्यमानस्य विदग्धस्याम्लमावतः ।

आशयाच्यवमानस्य पित्तमच्छमुदीर्यते ॥ (Caraka : Cikitsā 16 : 10).

4. *Aṣṭāṅgahṛdaya* : Sūtra 3 : 53.

5. Suśruta : Uttaraśāstra 40 : 169, *Aṣṭāṅgahṛdaya* Sūtra 3 : 50.
Aṣṭāṅgasamgraha : Śārīra : 5.

6. Caraka : Cikitsā 16 : 57.

7. Caraka : Cikitsā 16 : 56, *Aṣṭāṅgahṛdaya* : Sūtra 3 : 50.

8. Suśruta : Śārīra 4 : 4, *Aṣṭāṅgasamgraha* Śārīra 5.

between *dhātus* and *āsayas*. From available descriptions of this structure, it is seen that *kalā* resembles, in some respects, the semipermeable membrane and in other respects the mucosal lining of hollow visceral organs such as the mouth, oesophagus, small and large intestines. In the present context, the description of *pittadharā kalā* would appear to refer to the lining membranes and in special to the lining membranes of the gastro-intestinal tract extending from the pyloric region, up to the ileo-cecum. In fact, the lining or the mucosal-membrane (including the submucosa) of the intestines—small intestine in this context—represents the demarcation between the underlying *srotāṁsi* and *mūṁsa dhātu* on the one hand and, the food in the lumen of the gut on the other. In addition, it not only serves the purpose of a covering membrane but also (a) as a system of glands, which provides the necessary digestive enzymes, (b) as the surface, on which, various kinds of digestive reactions take place, and (c) as the surface from which absorption of the digested *āhārarasa* takes place. The *grahāṇī* or *pittadharā kalā*, as it is also called, has been uniquely contrived to meet the foregoing threefold functions.

The significance of this arrangement, in keeping with the observations made by Vāgbhaṭa to *pācaka-pitta*, its place and functions, and, that of *grahāṇī*,¹ *vis-a-vis* *pittadharā kalā*

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1. Sri S. C. Dhyani, in his thesis on "*Grahaṇīrōga*" offered for his post-graduate diplomaship in 1956, has effectively shown that, in view of evidence gathered by him from the available editions of *samhitā-granthas* and modern developments in the field of physiology of digestion and metabolism, that the *urdho-āmāśaya* is the region of the stomach which extends from the fundus to the pyloric area and *adhoro-āmāśaya* is the region which extends from the pyloric-actrum to the ileo-cecum. He has, also, defined the latter portion as *grahāṇī*, in view of the fact that (1) the pyloric sphincter, at the outset, retains the food in the stomach for the duration of gastric digestion and the production of acidified chyme; (2) the duodenum exercises a regulating control over the secretion of some of the important digestive juices and gastric activities. The remaining portion

and its function as described both by Susruta and Vāgbhaṭa and lastly Caraka's reference to the physiological events which are stated to take place when *āhāradravyas* which have previously undergone *amlabhāva* in the *ūrdhva-āmāśaya* are passed on to the next lower portion of the *koṣṭha* leading to the secretion of *accha-pitta*, can be summed up in the light of known facts of anatomy and physiology as follows :—

The *āhāradravyas* of different kinds—*aśita*, *pīta*, *liḍha* and *khādita*—attain (i) *madhurabhāva*, as soon as they reach *āmāśaya*. This stage of digestion is reminiscent of salivary digestion which is completed in the fundus of the stomach, where the insoluble starch-polysaccharide—is converted to soluble dextrin, under the influence of salivary amylase (ptylin). Thus, the cooked starch is seen to proceed through the following stages in this reaction :

starch→erythrodextrin→achrodextrin→stable dextrin.

The action of the Salivary amylase is of the nature of *bhinnaśaṁghāta* or splitting, brought about by hydrolysis. The

of the area, known as *grahāṇī* is lined with *pīṭtadhara kālā*. It provides the essential ingredients of *jāṭharāgni*, responsible for the completion of *aṇupāka*, which forms part of *jāṭharāgni vyāpāra*. In addition, the formation of *sāra* or *annarasa*—chyle, and the separation of it from *kitta*—the undigested residue of the food, takes place in this area. The *sārabhāga*, corresponding to chyle, is retained in the area for the duration, required for its *śeṣaṇa* or absorption, while the *kitta* or the undigested residue of the food is removed and passed on to the *pakvāṇa*—large intestine—under the influence of *samāna vāyu*. He has thus shown with convincing evidence that the entire small intestine commencing from the antrum of the pylorus including the pyloric sphincter to ileocecal sphincter, represent a total entity, spoken of as the *grahāṇī*. Further, he attached significance to the area extending from pylorus and ending with duodenum and showed that this is the operative and controlling part of the entire *grahāṇī* system. (S. C. Dhyani ; *Grahani Roga* Post Graduate Thesis : 1956 : pp. 23-40).

final *rasa* or taste of the resultant product, in the upper portion of the *ūrdhva āmāśaya*, is *madhura*.

(ii) This digestion is brought to an end by the secretion of hydrochloric acid. Here is seen to commence the second part of the *avasthāpāka*, when the *āhāra*, is stated to undergo *amlabhāva*, corresponding to the conversion of insoluble proteins into soluble protein, under the influence of pepsin, in the presence of hydrochloric acid. The protein fraction of the food, proceeds through the following stages :

protein→proteoses→peptons before it is rendered soluble.

The final outcome of the entire gastric digestion is the acidified chyme, which has been characterised by Caraka as *vidagdha*¹, which term, as interpreted by Cakrapāṇi Datta is *pakvūpakva*² or *klñcītpakva-klñcidapakva* (i.e. partly digested). The implication of this phase of digestion as described by Caraka and elaborated by Cakrapāṇi Datta is that the *āhāra*, in this state, is not yet fit for absorption and utilisation for *bhūtāgni* and *dhātvaṅnipāka*.

It is of significance, in this connection to note that Caraka and Vāgbhaṭa have mentioned that *māmsa rasa* (muscle-juice) stimulates *jāṭharāgni*.³ This suggestion is reminiscent of the modern finding that, the "humoural phase" of the secretion of gastric juice, "depends in some way on the presence together in the stomach of food and gastric juice. It must be the product of the action of the gastric juice on the food which acts as a secretagogue; that this is so is proved by digesting the meat *in vitro* with gastric juice and, then, giving the solution by stomach tube, when the secretion begins almost

1. परन्तु पच्यमानस्य विदग्धस्याम्लभावतः ।

आशयाच्छयमानस्य पित्तमच्छमुदीर्यते ॥ (Caraka Cikitsā 15 : 10).

2. विदग्धस्येति पक्वापक्वस्य—(Cakrapāṇi on above).

3.(a) प्रसहानां रसैः साम्लैर्भोजयेत् पिशिताग्निम् ।

लघु-तोष्णोष्णशोषित्वाद् दीपयन्त्याशु तेजसम् ॥

(Caraka: Cikitsā 16 : 210).

(b) *Aṣṭāṅghrdaya: Cikitsā* 10 : 76.

at once."¹ The humoral substance thus produced by gastric mucosa arising out of the action on the latter by polypeptides, is known as the Gastrin² which is considered to be responsible for the profuse secretion of gastric-juice.

Resuming from where we digressed—the digression was necessary to emphasise the fact that the *amlatva* attained by the food, at this stage of *āhāra pacana*, is due to an *amla* factor secreted by the *ūrdhva-amāśaya*.³ Synchronising with the passage down of the *āhāra* which has attained *amlabhāva* into the next lower portion of the *mahāsrotas*, *accha pitta* is stated to be secreted. This is a very significant and, possibly a very early observation in that it has been shown by recent advances in experimental physiology that the acidified chyme as it passes down slowly from the pylorus into the duodenum acts as a secretagogue and stimulates the duodenal glands (Bruner's glands), to secrete a number of internal secretions which in their turn have been shown to be responsible for making available the bile and pancreatic juice to the duodenum for carrying out further digestion of the partly digested chyme. The important internal secretions which are shown to be secreted by duodenal glands, under the influence of acidified chyme are : (i) secretin, (ii) pancreozymin, (iii) cholecystokinin and (iv) entero-gastrone. It has been shown that "the flow of pancreatic juice like the flow of bile is regulated hormonally by the introduction of gastric chyme into duodenum. Pro-secretin granules in the mucosa of the duodenum are apparently activated by the acid of the chyme to yield secretin which enters the circulation to stimulate the acinous tissue of the pancreas and promote the secretion of pancreatic juice."⁴ "The secretion of pancreatic juice is

1. Lowatt Evan's : Principles of Human Physiology ; page 876 ; 11th edition.
2. There is a controversy, if gastrin is the same as histamine.
3. Modern advances have identified this factor as hydrochloric-acid.
4. Abraham White et al : Principles of Biochemistry, p. 445 ; Mc Graw Hill Publication 1954.

under both neural and hormonal control. The presence of secretagogue or acid in the upper duodenum results in the liberation into the circulation of a hormone—secretin—which stimulates the flow of pancreatic juice. Since secretin is effective in the atropinised animal as well as after a section of vagus a direct action of the hormone on the secretory cells may be assumed. The pancreatic juice obtained after secretin stimulation is copious in volume relatively deficient in enzyme action and of normal electrolytic composition... Secretin also enhances the secretion of bile and intestinal juice."¹....."A second intestinal hormone—pancreozymin—which unlike secretin, stimulates the secretion of enzymes by the pancreas, has been stated to occur in intestinal mucosa....."² "The contraction of gall bladder is apparently under hormonal regulation; the hormone cholecystokinin, arising in the upper segment of the small intestine and entering the circulation, when fatty foods are introduced into this portion of the intestine.....results in the prompt contraction of the normal gall bladder and discharge of its contents."³ "Emptying of the gall bladder occurs only under the influence of partially digested food in the intestine. This seems to be under neural control, but contraction and emptying of the gall bladder may be observed after complete denervation of the organ and introduction of partially hydrolysed lipid into duodenum. Acid extracts of duodenal mucosa contain a material called cholecystokinin, believed to be a hormone, released by small intestine."⁴ "Of particular interest in this connection is the inhibition of gastric secretion which results from the presence of sufficient quantities of lipid in the upper duodenum. Since this inhibition is also manifest in subcutaneously transplanted gastric pouches the effect has been ascribed to a hormone—enterogastrone."⁵ A mention has to be made in this connection to the humoral regulation of intestinal juice; "It has

1. Abraham White *et al* : *op. cit.*, p. 751.

2. *Ibid.*, p. 751-752.

3. *Ibid.*, p. 454.

4. *Ibid.*, p. 754.

5. *Ibid.*, p. 749.

been established that the presence of chyme in the small intestine calls forth still another hormone.....This one has been labelled as enterocrinin and it is thought to be a potent stimulator of the cells which manufacture intestinal juice."¹ It has been shown by Grossman that suitably prepared extracts increase the rate of succus-entericus secretion by the jejunum and ileum and also, increase the enzyme component of the secretion.²

The table below will furnish the entire picture of the hormonal control of the *ūrdhva āmāśaya* and the first upper segment of the *grahāṇī*.³

Endocrine glands and hormones	Principal site of action	Principal processes affected
Secretin	Pancreas	Secretion of alkali and fluid.
Pancreozymin	Pancreas	Secretion of digestive enzymes
Cholecystokinin	Gall bladder	Secretion and emptying
Enterogastrone	Stomach	Inhibition of mobility and secretion
Gastrin	Stomach	Secretion of acid

From the foregoing experimental observations, cited from more recent advances, it would seem that the *vidagdhāhāra* from the *āmāśaya*, which is *amla* in *rasa*, stimulates the humoral mechanism, located in the upper segment of *adho-āmāśaya* and the discharge of *accha pitta* into this area. The term *accha* has been interpreted by Cakrapāṇi Datta and Gaṅgādhara Sena as *aghana* and *svaccha*, meaning thin and clear respectively.⁴ It

1. Langley and Chiraskin : The physiology of Man : page 409, Mc Graw Hill Publication, 1934.
2. Grossman M. I. Physio, Revs, 30, 33, 1950.
3. Abraham White *et al* : Principles of Biochemistry : p. 871. Mc Graw Hill Publication, 1954.
4. (a) Cakrapāṇi Datta on *Caraka* : *Cikitsā* 15 : 10.
(b) Gaṅgādhara Sena on the same.

is obvious that the concept of *acchapitta* includes the gall bladder bile and pancreatic juice, which together have been shown to be responsible for proceeding with further stages of digestion of fats, proteins and carbohydrates in the small intestine. This concept may also include the activities of the intestinal juice, viz., succus-entericus. *Acchapitta* would, therefore represent a total concept; possibly it forms part of the much wider concept—*jāṭharāgni* (*koṣṭhāgni* or *pācakapitta*).

The facts reviewed above represent but one aspect of the concept of *pācakāgni* or *pācaka pitta* which may have to be studied with the structure known as *grahaṇī vis-a-vis, pitta* (agni-) *dharā kalā*, described both by Suśruta and Vāgbhaṭa. There still remains another and perhaps, a major aspect of this concept, which is of fundamental importance. It relates to the observation made by all the three main authors of *Āyurveda* (*Vyḍdhatrayī*) that *antarāgni* contributes to and augments the functions of other *agnis*, which are found elsewhere, in the body. For example, says Caraka, *koṣṭhāgni* is considered to be the leader of all factors concerned with metabolism in the body. They are all derived from it. Their activities or otherwise, are dependent upon an increase or decrease as the case may be of *jāṭharāgni*.¹ Says Suśruta, "by a dispensation which is unseen (a cause which can not be perceived or explained and which is hidden), *pitta* which is located in an area between *āmāśaya* and *pakvāśaya*, is responsible for the digestion of four kinds of food ingested by living beings and the elimination of the residue in the form of urine and faeces after the completion of the process. Located as it is in its own place (between *āmāśaya* and *pakvāśaya*) it contributes to and augments the functions of other locations of *pittas*, in the performance of actions. This *pitta* is, therefore, spoken of as *pācakāgni*.² Says

1. अन्नस्य पक्ता सर्वेषां पक्वतामविषो मतः ।

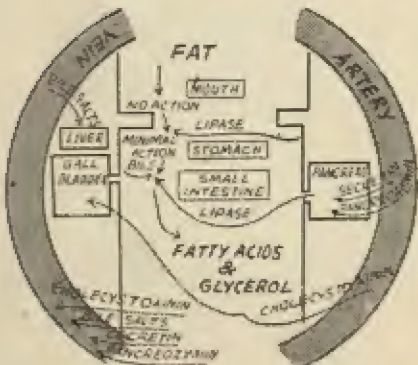
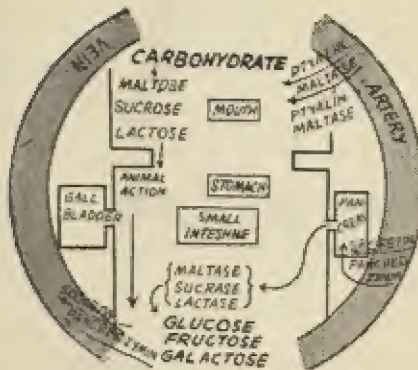
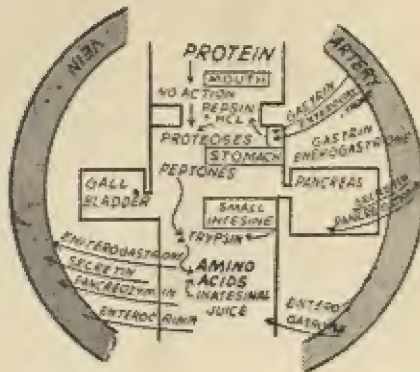
तन्मूलास्ते हि तद्दृष्टिश्चवृद्धिश्चात्मकाः ॥ (Caraka : Cihitsā 15 : 39).

2. तच्चादृष्टहेतुकेन विशेषेण पक्त्वामाशयमध्यस्थं पित्तं चतुर्विधमन्नपानं पचति, विवेचयति च दोषरसमूत्रपुरीषाणि तत्रस्थमेव चात्मशक्त्याशेषाणां पित्तस्थानानां शरीरस्वात्मिककर्माणां अनुग्रहं करोति, तस्मिन् पित्ते पाचकोऽग्निरिति संज्ञा ।

(Suśruta : Sūtra 21 : 10).

II

PĀKA OF DIFFERENT TYPES OF FOOD





Vāgbhaṭa, in his *Aṣṭāṅgahṛdaya*¹ and *saṁgraha*² that the *pitta*, located between *pakvāsaya* and *āmāsaya*, is *pāñcabhautika* and a *drava* inspite of which it performs actions like *anala* or fire, largely due to the predominance of its *tejas* component over the remaining members of the *bhūta pentad* that composes it. This fact is inferred from the way in which it performs *pākādi karmas*, such as the digestion of food and separation of *sāra* from *kitta*. In addition, while being located in its own place, it contributes to and augments the functions of other *pittas* elsewhere in the body.

In the chapter "*Doṣādivijñānya*" of his "*Samgraha*", Vāgbhaṭa has stated that : "A decrease or an increase of the *dhatus*, occur, according as the *tikṣṇatā* or the *mandatā* of the aspects of *pācakāgni*, present in the *dhatus*.

"As the flame of the forest fire tends to increase or decrease, according to the quantity (more or less as the case may be) of the *indhana* (available in the proximity), so also is the case with *dhātuparamparā*. *Dravyas* are either *tūlya* or *viśiṣṭa*, which cause an increase or decrease, as the case may be, of the *dhatus* due to properties potentially inherited by them, as in the case of a seed ; "homologous properties of *dravyas* cause sufficient and rapid increase of identical or homologous properties in the *dhatus*." ³

1. पंचभूतात्मकत्वेऽपि यत्तैजसगुणोदयात् ।
त्यक्तद्रवत्वं पाकादिकर्मणाऽनलशब्दितम् ॥
पचत्यनं विमज्जते सारकिहौ घृथक् तथा ।
करोति बलदानेन पाचकं नाम तत्स्मृतम् ॥

(*Aṣṭāṅgahṛdaya: Sūtra 12 : 10-12*).

2. *Aṣṭāṅgasaṁgraha: 20 : 5.*
3. ये पाचकांशो धातुस्थास्तेषां मान्वातिनैः कृण्वतः ।
बुद्धिः क्षयश्च धातूनां जायते शृणु चापरम् ॥
परम्पर्येऽपि दावाद्यैस्तत्तत्प्राप्येन्धनं शिखा ।
बुद्धिक्षयौ यथा याति तथा धातुपरम्परा ॥
द्रव्यं तुल्यं विशिष्टं हि स्वं स्वं बुद्धयै क्षयाय च ।
प्रस्थात्मशीजनैर्धेस्मात् शृणुमाशु च जायते ॥

(*Aṣṭāṅgasaṁgraha: Sūtra 19 : 16-18*).

Scheme representing the relationship between *Pācākāgni* and other *Pittas* and *Agnis* of the body :

<i>Bhrājaka</i>	<i>Ālocaka</i>	<i>Raṅjaka</i>	<i>Sādhaka</i>
<i>Pitta</i>	<i>Pitta</i>	<i>Pitta</i>	<i>Pitta</i>

Pācākāgni in *Koṣṭha*
(Producing *annarasa*)

Rasadhātuvāgni
Pācākāṁśa
Sthāyirasa

Raktadhātuvāgni
Pācākāṁśa
Sthāyirakta

Māṁsadhātuvāgni
Pācākāṁśa
Sthāyimarṁsa

Medodhātuvāgni
Pācākāṁśa
Sthāyimedas

Asthidhātuvāgni
Pācākāṁśa
Sthāyiyasthi

Śukradhātuvāgni
Pācākāṁśa
Sthāyīśukra

Majjadhātuvāgni
Pācākāṁśa
Sthāyimajjā

Again in *Aṣṭāṅgahṛdaya*, he has summed up the earlier *Saṁgraha* version quoted above in the following terms :

“Moieties of *kāyāgni*, which is located in its own place are distributed to and permeate through all the *dhātus*; a decrease of it makes for an increase of the *dhātus*, while an increase of it makes for the decrease of the *dhātus*.”¹

These two references, studied together, with the reference from *Caraka Saṁhitā* that “*Pācākāgni* is the leader of all *agnis*” open out many and far-reaching possibilities. Stated in brief these references envisage a generic and intimate relationship that is stated to exist between the *pācaka pitta* (*agni*) located between the *āmāśaya* and *pakvāśaya* on the one hand

1. स्वस्थानस्वस्य काशधेरंशः धातुषु संस्थिताः ।

तेषां सदातिदीप्तिभ्यां धातुवृद्धिस्तयोद्भवः ॥

(*Aṣṭāṅgahṛdaya*: *Sūtra* 21 : 34).

and, the *aśas* of it present in the *dhātus* on the other. The increase of the one (quantitative and functional), would appear to determine an increase *paripassu* of the other. The outcome of an increase or decrease as the case may be of the *pācakāśas* in the *dhātus*, would appear to make for a decrease or increase of the *dhātus* respectively, subject of course to the availability or otherwise of *indhana*, represented by *poṣakadravyas*. This has been illustrated with the simile of the forest fire and the availability of the fuel in the proximity of the fire. If the nutrition available in the proximity is homologous to the *dhātu*, which is to be nourished by it, then, the *pācakāśa* aids the normal process of *dhātuvṛddhi*. If, on the other hand, the *poṣakadravyas* is not *tulya* (i.e., it is non-homologous) and is *viśiṣṭa*, then, *dhātus* undergo *kṣaya*—the *pācakāśas* corresponding to forest fire consumes or destroys the *dhātus* themselves. The analogy, here relates to the scarcity of nutrition homologous to the tissues which in effect can be compared to scarcely vegetated forest where one of the two things may happen viz., the complete consumption of the available trees and the final extinction of the fire itself or if the jungle is densely vegetated the fire would spread throughout and destroy the jungle. The same is the case with *pācakāśas* in the *dhātus*, where suitable *indhana* is either deficient or is not available, the *pācakāśa* in the *dhātus* may burn the *dhātus* themselves—thus, making for their *kṣaya*. If on the other hand, there is a deficiency in the *dhātus* of the *pācakāśas*, then, in this view, there may be a *vṛddhi* or increase of the *dhātus*.

The idea underlying the classical description of the behaviour of the *pācakāśas* in the *dhātus*, in the two circumstances stated above, can be illustrated with the example of the conditions described as *atyagni*—known also as *bhāsmaka*, and *mandāgni* corresponding in modern parlance to hyper and hypo-metabolism respectively. The former condition is usually associated with hyper-thyroidism which as is well known is marked by a gradual increase or speeded up cellular respiration. This results in the liberation of so much of heat that the affected subject feels hot all the time. In spite of

voracious eating so much of food is burnt that the body weight may decrease; the patient is constantly under nervous tension, highly irritable by stimuli and yet unable to do sustained work due to the lack of fuel reserve and suffers retarded growth. The symptoms of the analogous *tikṣṇāgni* in the patient is that he easily digests even a very heavy meal in a very short space of time. In spite of his all too frequent and heavy meal he continues to suffer from voracious hunger, parched throat, palate and lips and other discomforts due to it.¹ The latter (hypometabolism) corresponding to *mandāgni* can be illustrated with low thyroxin availability—thyroxin activates cellular oxidative processes throughout the body and an insufficiency of this hormone has been shown to be followed by a reduction in the oxidative reaction,—the B. M. R. may fall to 25%. The other related symptoms of the condition are: the development of myxedema which is characterised by a reduction of mental and bodily vigour, the loss of sex drive, loss of hair and an abnormal thickening of the skin as if much water has been accumulated in it (oedema); it leads to an increase of body weight, since less food is burnt in the cells and much of it is stored as fat.

In our academic discussions at the Post-Graduate Training Centre, two possibilities as regards the statement that the *aśwas* of *pācākāgni* are responsible for *pacana* and *dahana karmas* in the *dhātus*, were examined in detail. The first possibility was an outcome of the preliminary experimental observations made by the professor of *Kāya cikitsā* at Mysore and Jamnagar from 1952 to 1958, on the effect produced by the fresh aqueous extract of the *agni (pitta) dhara kalā* (corresponding to the mucus membrane of the pylorus and duodenum), in cases of *jalodara*.² The theoretical basis for

1. स एवामिषवर्धमानोऽस्यग्निरित्याभास्यते, स मुहुर्मुहुः प्रभूतमन्वुत्तुक्तमन्नमाशुतरं पचति; पाकान्ते च गलतालबोधशोषदाहसन्तापानभवति; (*Suśruta : Sūtra : 35:24*).
(B) *Caraka : Cikitsā 15 : 217-220*.

2. Dwarakanath et al: A brief report on the preliminary observation on the effect of *Agnidharakalasāra* or a complete aqueous extract of gastric and duodenal mucosa in cases of *śaṭha* (Oedema) and *jalodara* (asciti): *Antiseptic : July 57*.

this experimental observation was the assumption that the *pitta* (*agni*) *dharā kalā* described by both Sūśruta and Vāgbhaṭa, may be the same as the mucus membrane of the pylorus and duodenum, in particular and the small intestine in general; the administration of an aqueous extract of this membrane should replace at least for the time being the deficit of *pācākāgni* the deficiency of which is stated to be the main etiological and pathological feature of *udara-roga*.¹ In a large number of cases of *jālodara*, in which *agnidharākala-sāra*, as the extract is known was administered, a dramatic clearance of the ascitic fluid through increased micturation was observed coinciding with progressive return of the patient to normal, increased appetite and capacity to digest food were observed. This phenomenon, according to some authorities is due probably to the inhibition as may be exercised by some factor present in the macosal extract of the anti-diuretic hormone of the posterior pituitary for it was seen that the pronounced diuresis noted in these cases, when this extract was administered was not observed when the same extract was administered to normal subjects. In addition, the observations made by Dr. F. I. Tovey² showed that in advanced cases of liver cirrhosis with ascitis preparatory administration of duodenal extract for 10 to 15 days followed by 'mersalyl'³ diuretic response was noted which could not be observed either with the extract or mersalyl alone. There is, therefore, some basis for the belief that some principle in the extract works by counteracting the high secretion and retention of the anti-diuretic hormone which is known to be present in cases with cirrhosis and thus, make it possible for the mercurial diuretic to act on the kidney.⁴ On the basis of the foregoing observa-

1. (a) अग्निदीपान्मनुष्याणां रोगसंवाः वृथस्त्रिधाः ।

मलवृद्ध्या प्रजायन्ते विशेषेणोदराणि तु ॥ (*Caraka: Cikitsa* 13 : 9).

(b) *Aṣṭāṅgahṛdaya: Nidāna* 12 : 1.

2. Frank I. Tovey : Personal communication to Prof. C. Dwarkanath (1957).

3. Mersalyl is a powerful mercurial diuretic.

4. Frank I. Tovey : *Ibid*.

tions, it was suggested that the *pittadharā kalā* may contain, yet, another factor which may regulate the pituitary control over thyroid and its hormone. If this hypothesis can be sustained by experimental and clinical observations then hyper-metabolism associated with thyrotoxicosis, corresponding to *atyagni* or *bhasmaka* and hypo-metabolism, generally associated with such conditions as Simmond's disease (in which there is a low secretion of thyroid hormone) and hypothyroidism may be explained. *Paripassu*, the correlation between *pācakāgni*, located between *pakvāsaya* and *āmāsaya* and the *pācakāmsas* said to be present in the *dhātus* may also be explained.

An alternative possibility has emerged out of the more recent studies and discussions, the author had with his professor, on the significance and the implications of the doctrine, under reference, *vis-à-vis*, the group of enzymes included under the category of *cathepsins*.¹ Cathepsins are proteolytic enzymes, present in all the tissues of the body. There are four of them viz., I, II, III, IV and they are similar to pepsin, trypsin, aminopeptidase and carboxypeptidase respectively, in their proteolytic activities. They are seen to be concerned in the break-down of tissue protein into amino acids throughout the body and especially in the liver, spleen and kidney.² Authorities, entitled to an opinion consider that some of the enzymes viz. pepsin, trypsin, dipeptidase etc. are cathepsins present in the stomach and intestine. These latter bring about the breakdown of protein into amino acids by hydrolysis. It has been shown that these enzymes may catalise both the break-down and synthetic reactions. Cathepsins have been shown, both *in vitro* and *in vivo*, to breakdown

1. Cathepsin—(Greek—Kathepsin, to boil down). Any one of the several proteolytic enzymes present in tissue catalyzing the hydrolysis of high molecular weight proteins to proteoses and peptones, and having an optimum pH. between 4 and 5. It is believed that after death the tissues become acid and cathepsin produces autolysis (proteolysis).
'Gould' Medical Dictionary, p. 217 : 1956 edition.

2. West and Todd: Text Book of Biochemistry: Second edition, p. 1049.

proteins into amino-acids by hydrolysis and pepsin and trypsin etc., could synthesise proteins in all cells by dehydration. Generally speaking, conditions of mass action and energetics are such that protein synthesis is appreciable only in living cells, while digestion predominates in the gut.¹ Weisz has observed that all cells contain cathepsin enzymes mediating the synthesis of cellular proteins, after death, when reaction-energy and amino-acid raw materials are no longer supplied, the same enzymes decompose the protein which they originally aided to build. Post-mortem disintegration is partly due to this and partly due to bacterial action.² & ³

Although, little is known about the specific mechanism and enzymes which are responsible for the synthesis of body proteins from amino-acids during growth, regeneration of injured tissue and for the maintenance of tissue mass of the adult animal, none-the-less, recent contributions as regards cathepsins point to the fact that the important proteolytic and hydrolytic enzymes of gastro-intestinal tract and the cathepsins of the tissue belong to the same generic and functional group and the possibility of an interrelationship between the two cannot be ruled out. In any event, these contributions when examined in the light of *pācakāgni* or *pācaka pitta* would appear to suggest that cathepsins in the tissues may represent the *pācakānśas*, while the *pācaka pitta* itself continues to be located in the intestine. *Aṣṭāṅga Saṁgraha's* citation, in this regard, it is considered, can be explained having regard to cathepsins in the tissues and the lack of *indhana* (amino-acid raw material) which may lead to the breakdown or destruction of *dhātus* by hydrolysis.

The foregoing represent an over-all picture of the concept of *pācakāgni* (*pitta*). As mentioned in pages 43-44 this concept comprehends *jāṭharāgni* and *bhūtāgni vyāpāra*, which are important, in the context of this thesis, for according to Caraka, the criterion of efficient functioning of *agni* is to be

1. Weisz : Biology : Second edition : pp. 343-349.

2. Ibid. p 61.

3. Cakrapāṇi on Caraka : Śarīra 1 : 59.

determined by *jaraṇaśakti*¹ or the capacity of the human organism to digest the food ingested in fourfold manner. This has reference to digestive events which take place from the time the food enters the mouth to the time the *sāra* or the nutrient fraction of it is separated from the *kitta* or the undigested residue. These events, in the parlance of modern physiology and biochemistry are salivary, gastric and intestinal digestion. It is not as though these three aspects of digestion are different and unrelated events. They form part of a process represented by distinct phases—each phase contributing to and determining the events of the next succeeding phase. The foregoing are in keeping with the description of *āhārapācanakriyā* in the Āyurvedic classics, which, by the way, derive experimental and clinical confirmation from modern developments in related fields of sciences, as can be seen in what follows.

Anatomical considerations ;—

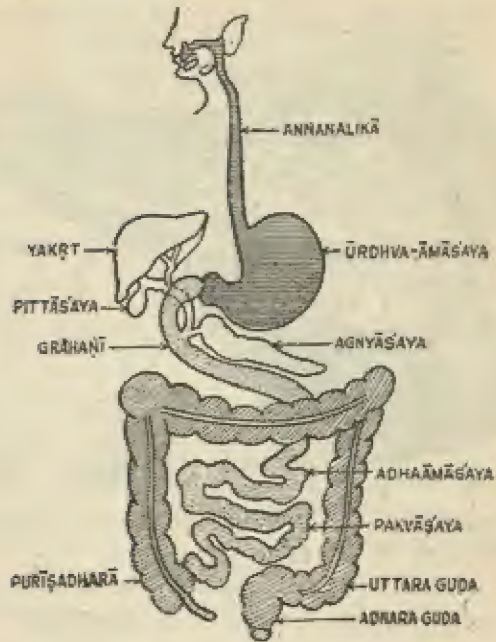
According to *Āyurveda*, the *mahāsrotas*, corresponding to the alimentary tract, is immediately concerned with the process of alimentation (ingestion and egestion). *Mahāsrotas* is also spoken of as *koṣṭha*. It may be noted here, that the term *koṣṭha* has several synonyms, such as *mahāsrotas* (the great channel), *śarīra madhya* (the middle portion of the body or trunk), *mahānimna* (the great cavity), *āmapakvāśaya* (the organ of preliminary and final aspects of digestion) and *ābhyantararogamārga* (internal pathway of disease).² All these terms pertain to the trunk with its great cavity, partitioned into two parts, the *uroguhā* or the thoracic cavity and the *udaraguha* or the abdominal cavity. In another sense, the *āśayas* contained in them, such as the *nābhī* (umbilicus ?),³

1. *Caraka: Vimāna* 4 : 8.

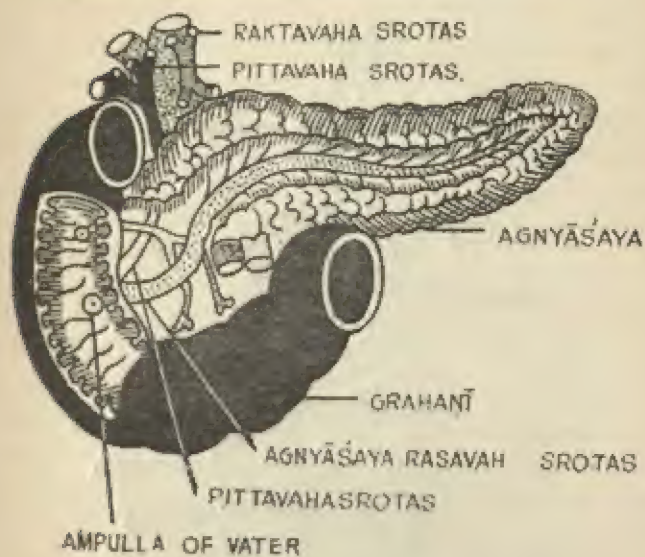
2. कोष्ठः पुनरुच्यते महाकोष्ठः, शरीरमध्यं महानिम्नं आमपक्वशयश्चेति पर्याय-
शब्दैः तन्त्रे । स रोगमार्गः आस्यन्तरः । *Caraka : Sūtra* 11 : 48.

3. It is not clear from the available texts—if *nābhī* represents umbilicus or it is an anatomical landmark to indicate an organ or organs contained in the corresponding area of the abdomen. In the view of the author '*nābhī*' when treated as an

III DIFFERENT PARTS OF MAHASROTAS



VI
GRAHĀṆĪ AND AGNYĀŚĀYA (DISSECTED)



hṛdaya (heart), *plihā* (spleen), *vrkka* (kidneys), *vasti* (bladder), *puriṣādhāra* (sigmoid colon, known also as pelvic colon), *āmāśaya* (stomach and intestine), *uttaraguda* (upper segment of the rectum), *adhoguda* (the lower segment of the rectum including the anus), *kṣudrāntṛa* (small intestine), *sthūlāntṛa* (large intestine) and *vapūvahana* (omentum).¹

It would seem from the discussion above that there is a mix up in the enumeration of the anatomical and functional parts, especially of the gastro-intestinal tract, i. e., *koṣṭhāṅgas*, which when properly classified will work up as follows :—

Anatomical divisions of *mahāsrotas* : *Āmāśaya* (stomach), *kṣudrāntṛa* (small intestine), *uṇḍuka* (ileo-cecum), *sthūlāntṛa* (large intestine), *uttaraguda* (upper segment of the rectum) and *adhoguda* (lower segment of the rectum with anus.)

Physiological or functional divisions of *mahāsrotas* : *Āmāśaya* with its two parts viz. *ūrdhva* and *adha-āmāśaya*² (also known as *pacyamānāśaya*) (stomach and small intestine including duodenum), *pakvāśaya* (large intestine) and *puriṣādhāra* (pelvic flexure ending in anus).

According to *Suśruta*, the following constitute the *koṣṭha* : the *āmāśaya*, *pakvāśaya*, *agnyāśaya*, *mūtrāśaya*, *raktāśaya*, *hṛdaya*,

organ may correspond to *agnyāśaya*, interpreted as the pancreas. Pancreas, as we know today plays two roles viz. digestive and metabolic—the former relates to important enzymes it contributes to the digestion of proteins, carbohydrates and fats in the small intestine, and the latter, to sugar metabolism. An important organ like pancreas lying immediately above *nābhi* cannot have been missed by the ancient authors of *Āyurveda* who have mentioned the liver, spleen, kidneys bladder etc.

1. पंचदशकोष्ठज्ञानि तद्यथा—नाभिश्च, हृदयं च, श्रोमं च, यकृश्च, श्लीहा च, वृको च, वस्तिश्च, पुरीषाधारश्च, आमाशयश्च, पक्वाशयश्च, उत्तरगुदं च, अधरगुदं च क्षुद्रान्त्रं च स्थूलान्त्रं च, वपावहनं चेति । (*Caraka : Sūtra* 7 : 10).
2. पित्तस्थानेष्वामाशयः इति आमाशयास्याधोभागः । क्लेयस्थानेषु आमाशयः इति आमाशयस्योर्ध्वभागः ॥

(*Cakrapāṇi on Caraka : Sūtra* 20 : 8).

uṇḍuka, *phuphusa*.¹ This description would appear to be purely functional. It may be noted here that these organs constitute the viscera of the abdomen and thorax. According to this view, functional divisions of *mahāsrotas* will be as follows—*āmāśaya* (stomach), *pakvāśaya* (large intestine) and *pacyamānāśaya* (between *āmāśaya* and *pakvāśaya*² corresponding to *kṣudrāntṛa* or small intestine). The latter is also known as *grahāṇī*. Suśruta³ has very clearly stated that *āmāśaya* is the seat of *kapha*, whereas, Caraka⁴ and Vāgbhaṭa have described *āmāśaya*, not only as the seat of *kapha* but also as that of *pitta*. It is probably with a view to clarifying the position that Cakrapāṇi differentiated *āmāśaya* into two functional parts, viz., *ūrdhva* and *adha-āmāśaya*, which later, he has described as *pacyamānāśaya*.

It is of interest to note that of the fifteen *koṣṭhāṅgas* described by Caraka and of the eight by Suśruta, *phupphusa* (lung), *āmāśaya* in its two parts—*ūrdhva* and *adha*, the latter correspond to *kṣudrāntṛa*, *nābhī* (pancreas?), *vṛkka* (kidney), *vasti* (bladder), *pakvāśaya* (large intestine), *puriṣūdhāra* (pelvic colon), *uttaraguda* and *adhoguda* (upper and lower segments of rectum) are seen to be developed from the “primary alimentary tube” laid down in the embryo, as will be seen from the following :—

“The embryonic digestive tube is essentially a blind tube of entoderm as it is first formed. The muscular layer which surrounds the tube is formed secondarily from splanchnic mesoderm. An oral cavity (or stomodeum), which will later become the mouth, invaginates from the anterior end of the embryo to meet the anterior end of the entodermal tube. The surface ectoderm is pulled in with this invagination and lines the anterior part of the oral cavity. In the same way a posterior ectodermal invagination pushes in to meet the

1. स्थानान्यामानिपक्वानां मूत्रस्य रश्मिरस्य च ।

इदुण्डुकः पुष्पकुसुमं कोष्ठ इत्यभिधीयते ॥ *Suśruta : Cikitsā* 2 : 12.

2. (a) *Suśruta : Uttaratantra* 40 : 169.

(b) *Suśruta : Sūtra* 21 : 10.

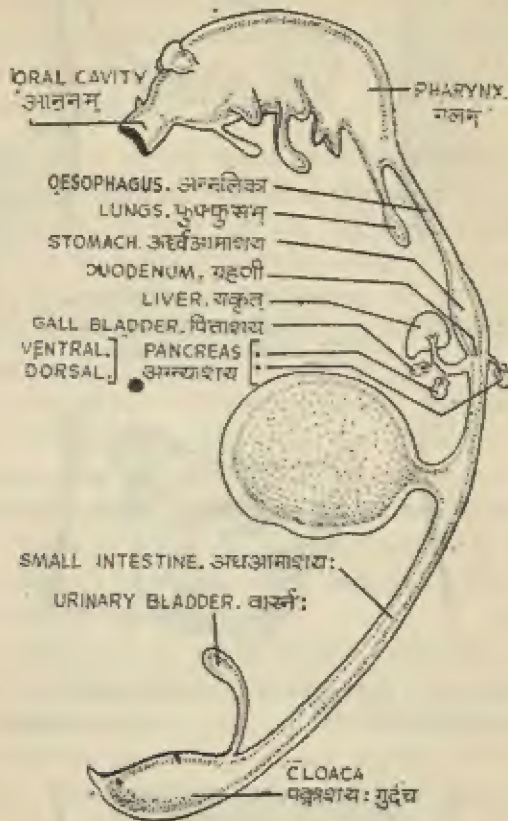
3. माधुर्यात् पिच्छित्वाच्च प्रकलेदिवाचयेव च ।

आमाशये सम्भवति श्लेष्मा मधुरशीतलः ॥ *Suśruta : Sūtra* 21 : 13.

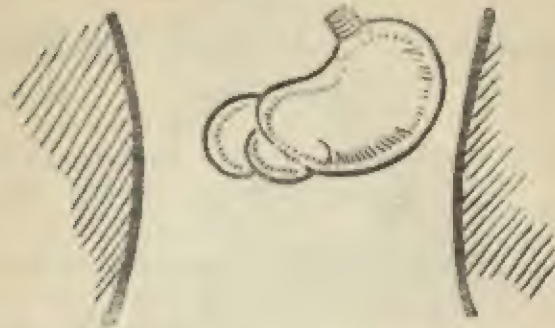
4. *Caraka : Sūtra* 20 : 8.

IV

EMBRYONIC DEVELOPMENT OF MAHĀSROTAS



DIFFERENT PARTS OF MAHĀSROTAS WITH THEIR SPECIALISED FUNCTIONS



1. **ORDHVA-ĀMĀSAYA** (a) Madhura Avasthāpaka
(Kledaka Kaphasāhna) Vidagdha Paka
(b) Amla avasthāpaka



2. **ADHAĀMĀSAYA, KṢUDRĀNTRA** Amlasavasthāpaka (Contd.)
ON PACYAMĀNĀSAYA (Annarasasāṣaṇa)



3. **PAKVĀSAYA ON**
STHŪLĀNTRA } Kaṣṭhāva
(Pīṣṭikarāṇa and Purīṣotpatti)

entodermal tube near its caudal end. The caudal end of the entodermal tube forms a common posterior opening called the *cloaca*. In mature animals that retains the cloaca, such as birds and reptiles, the urinary and reproductive ducts open into this common opening. The human embryonic cloaca soon divides to form the rectum dorsally and urinary bladder and uro-genital sinus ventrally. The urethral and anal canals are soon established and the cloaca disappears. The anal canal by virtue of its origin is lined with an epithelium of ectodermal origin.

The pharynx region has been discussed from the stand point of its derivatives. Certainly the structure derived from the pharyngeal arches and gill clefts constitute a most interesting part of the history of embryonic development.

The pharynx itself is a soft tube at the back of the mouth and leading to the oesophagus. The tonsil lie embedded in its lateral walls. The oesophagus is at first a short tube leading to a slight enlargement in the digestive tube—the stomach. During the fifth week the stomach enlarges and begins to assume the shape of the mature organ. It is originally located rather high in the body cavity, but during the sixth and seventh weeks the body elongates and the stomach appears closer to its permanent location. The oesophagus elongates at this time also.

"The liver arises as a diverticulum below the stomach from the region of the intestine destined to become the duodenum. The entodermal diverticulum grows into a thick walled visicle from which the liver tubesles and hepatic ducts arise. The entodermal ducts grow into splanchnic mesoderm which provides the connective tissue of the liver and its capsule. The posterior portion of the diverticulum gives rise to the gall bladder and cystic duct. The fetal circulatory plan provides that food-laden blood from the placenta shall pass through the liver. The liver becomes proportionately very large in the foetus, accounting for around ten per cent of the body weight in the fetus of nine weeks. The liver is still large at birth but represents approximately only five per cent of the body weight, while in the adult the proportional weight

shrinks to two or three per cent. The liver eventually becomes located below the diaphragm largely on the right side. The stomach lies to the left and is partially covered by the liver.

"Two diverticula from the primitive entodermal tube give rise to the pancreas. One evagination from the dorsal wall becomes the dorsal pancreas and the other evagination from the dorsal wall becomes the ventral pancreas. The duct of the ventral pancreas is associated with the common bile duct. The lengthening of the bile duct and the growth and flexure of the duodenum bring the ventral pancreas to a position directly below the base of the dorsal pancreas, and the two parts fuse in the embryo in seven weeks. The greater part of the mature gland is derived from the dorsal pancreas; and the ventral pancreas forms only the lower basal portion. The dorsal pancreatic duct joins the ventral duct in a manner to retain the base of the ventral duct and its primitive connection with the bile duct. The single duct of the mature pancreas, then joins the common bile duct in the ampulla of *Vater* and empties the pancreatic fluid into the duodenum along with that of liver.

"The intestine at first is a straight tube extending from the stomach to the cloaca. It is held in place by a connective tissue sheath called the mesentery. Anteriorly in the duodenal region there is both a dorsal and a ventral mesentery dividing the body cavity or coelom into right and left portions. Posteriorly the right and left coelom form a common cavity. The coelom, itself arises as a narrow cavity between layers of somatic and splanchnic mesoderm. The transverse septum which latter becomes a part of the diaphragm, separates the plural and cardiac cavities from the abdominal cavity. The lungs and heart occupy the thoracic cavity, and the intestine comes to lie in the abdominal cavity.

The intestine lengthens, forms a loop, and then grows rapidly to form so many coils that the small abdominal cavity apparently cannot contain them. A loop of intestine then pushes out into the umbilical cord at about five weeks. The abdominal cavity continues to enlarge and in the embryo of ten weeks the extended portion is pulled back through the

umbilical ring. The caudal part of the intestine is actually of smaller diameter than the small intestine in the early embryo. At a latter stage in its development as in the fetus of five months, it begins to resemble the large intestine of the new born infant.¹

"The area immediately posterior to the pharyngeal pouches give rise to a laryngotracheal ridge on its ventral surface in very young embryos. The primordial outgrowth of the larynx and trachea then arises as a bud from the primitive gut in this region. The tracheal bud elongates and branches to form broncheal buds. The whole structure is bilobed and is commonly called the lung bud. The bronchial buds by continued branching from the entire respiratory tree, the broncheal tubes, bronchioles, and alveoli. The bronchial buds are entodermal but they grow into a mass of mesenchyme from which will arise the supporting tissues of the lungs and bronchial tree; only the epithelial lining of the passage ways remain entodermal in origin. The lung buds grow out dorsally and on either side of the heart into that portion of the body cavity which will later become the pleural cavities. The lungs are small at birth since they are never fully expanded with air. While respiratory movements may take place before birth, the lungs are not functional until the new-born infant takes its first grasp of air. The lung tissue may not become completely inflated until several days after birth."²

AVASTHĀ PĀKA

Avasthāpāka refers to changes, which *āhāradravyas* undergo in the *koṣṭha*. Two phases of it have been described viz. *prapāka* and *vipāka*. *Prapāka* has been defined as *prathamapāka* or the first outcome of *pāka* or chemical action.³ *Vipāka* has been defined as the outcome of the action of *jāṭharāgni* on the *āhāra* substrate—the resultant of the previous

1. De Coursey : The Human Organism : 1955 edition, pp. 485-487.

2. Ibid. pp. 487-489.

3. प्रपाकतः इति प्रथमपाकतः । Cakrapāṇi on Caraka.

pāka,¹ i.e. *prathama pāka*, which is to be judged from the point of view of the taste of the end products of gastrointestinal digestion viz., *madhura* (sweet), *amla* (sour) and *kaṭu* (acrid or pungent).

It has been stated that *dravya* is the basis for *rasa*, *guṇa*, *virya*, *vipāka* etc., and therefore, it is of fundamental importance.² By *dravya* is meant the *aṇus* or atoms of the *bhūta* pentad. The main mode of the formation of compound substances is stated to proceed as follows : the *adhiṣṭhāna* or basis for the formation of a compound is *pṛthvi paramāṇu*, *ap* serves as the *yonī* or medium and, *agni*, *pavana* and *nabhas*, align themselves (in varying numbers and modes) in the compound.³

It was noted earlier at page 9 that *pṛthvi*, *ap*, *tejas* and *vāyu*, according to *Nyāya-vaiśeṣika* system have *aṇutva*, i.e., they are finite or atomic. *Ākāśa*, in this view, is *vibhu* (continuum or infinite). They are *kāraṇa dravyas*. But, in the view of *sāṃkhyas*, *paramāṇus* of *pṛthvi*, *ap*, *tejas*, *vāyu* and *nabhas* are all *kārya dravyas* and they are finite.⁴ This is also, the case with *nabhas* which, at the level of *tāmasāhamkāra*, has been stated to be *vibhu*. In the *Nyāya-vaiśeṣika* sense, the *aṇus* can neither be created, nor destroyed or altered. They are eternal. In this sense, the *aṇus* of *Vaiśeṣikas* are *ne-plus-ultra*.

It is the number in which different kinds of *bhūta paramāṇus* combine and their spatial relationship with each other, that confers on the compound thus formed, its characteristic *rasa*

1. वाठरेणाग्निना योगाद्बुदेति रसान्तरम् ।

रसानां परिणामान्ते स विपाक इति स्मृतः ॥ *Aṣṭāṅgahṛdaya* : *Sūtra* 9 : 20.

2. (a) द्रव्यमेव रसादीनां श्रेष्ठं ते हि तद्वाक्यतः ।

Aṣṭāṅgahṛdaya : *Sūtra* 9 : 1.

(b) *Suśruta* : *Sūtra* 40 : 15-18.

3. पंचभूतात्मकं तत्तु क्षमामधिष्ठाव जायते ।

अभ्युद्योन्वग्निपवननभसां समवायतः ॥

तन्निर्गुणविशेषश्च

Aṣṭāṅgahṛdaya : *Sūtra* 9 : 1-2.

4. The *paramāṇus*, in their turn, are stated to be composed by more elementary units of substances spoken of as *tanmātrās* which are five in number : viz. *śabda*, *spṛśa*, *rūpa*, *rasa* and

(taste), *vīrya*¹ (mode of energy viz., *uṣṇa* or kinetic and *śīta* or potential), *vipāka* (the outcome of the chemical changes to which the compound is subjected in the body, described in the terms of *rasa*), *guṇa* (quality) and *prabhāva*² (specific and characteristic property which may not be described or explained in terms of *rasa*, *guṇa*, *vīrya*, *vipāka*).

Compounds which are formed with the five kinds of *kāraṇadravyas* are *anitya* (transient); their qualities and properties are also transitory—they last as long as the combination lasts. *Āpus*, contained in a compound belonging to the same species, combining in the same number but in different spatial relationships may appear apparently to be identical in *rasa*, *guṇa*, *vīrya* and *vipāka*, but their actions in effect may be different and not be explicable from the point of view of *rasa*, *guṇa*, *vīrya*, *vipāka*. This peculiar and what to the ancient authorities appeared to be an unseen³ and inconceivable power (*acintya śakti*) has been explained by Professor C. Dwarakanath as follows : “Pressing the analogy of modern physico-chemical concept, isomerism, he explained the observed difference in the functional behaviour of two substances, which have an identical atomic structure but the atoms whereof are spatially aligned differently exhibiting distinctly different properties. He illustrated this difference with the example of ammonium cyanate and urea, and also with the common place example of the difference in the meaning and the

gandha lannātrās. These latter are the *kāraṇadravyas*, in relation to the *sthūlabhūta paramāṇus*, now under reference.

1. (a) शीतोष्णमिति वीर्यं तु क्रियते येन या क्रिया ।

नावीर्यं क्रियते किञ्चित्सर्वं वीर्यकृता क्रिया ॥ *Caraka : Sūtra* 26 : 65.

- (b) उष्णशीतगुणोत्कर्षात्तत्र वीर्यं द्विधा स्मृतम् ।

Aṣṭāṅghaṛdaya : Sūtra 1 : 17, & *Aṣṭāṅgasaṃgraha : Sūtra*.

- (c) शक्त्युत्कर्षं वीर्यशब्दो लोकेऽपि प्रसिद्धः । Hemādri on the above.

2. (a) रसादिसाम्ये यत्कर्म विशिष्टं तत्प्रभावजम् ॥

Aṣṭāṅghaṛdaya : Sūtra 9 : 26.

- (b) *Caraka : Sūtra* 26 : 67.

- (c) *Suśruta : Sūtra* 40 : 19-21.

- (d) *Aṣṭ. Saṃgraha : Sūtra* 17.

3. प्रभावोऽचिन्त्य उच्यते । *Caraka : Sūtra* 26 : 70.

significance of the terms 'God and Dog,' 'Pot and Top,' 'Karma and Amrak' etc." ¹

The digression into the nature of *dravya* became necessary in view of the description of the products which represent the final outcome of the *jāṭharāgni pāka*, in terms of their *rasa* or taste. The only important point to note here is the fact that changes in *rasa* are directly correlated to changes in the composition of *dravyas*, brought about under the influence of *jāṭharāgni*.

Thus, the *āhāra pāka* in the *koṣṭha* may be stated to proceed in the following order—

(1) The presence of food in the mouth is followed by the perception of its taste, under the influence of *bodhaka kapha*.

This *kapha* is stated to be present in the tongue
1. *Madhurabhāva* and it enables the perception of taste. ² The implication of *bodhaka kapha* needs an examination. It is obviously a fluid present in the mouth in which, food substances are dissolved or ionised; for a substance which

1. "According to this concept, substances may possess identity of chemical composition and yet exhibit different properties.

The cases of urea— $\text{C} < \begin{smallmatrix} \text{NH}_2 \\ \text{NH}_2 \end{smallmatrix}$ and ammonium cyanate— NH_4CNO can be cited as examples of isomerides. Both these compounds have the same molecular formula $\text{N}_2\text{H}_4\text{CO}$ and yet they are different in their properties. The same is also the case with ethyl ether— $(\text{C}_2\text{H}_5)_2\text{O}$ and butyl alcohol— $\text{C}_4\text{H}_9\text{OH}$. From these, it will be seen that the chemical composition which largely determines the secondary qualities of substances, such as *rasa*, *gūḍa*, *vīrya* and *vipāka* does not, therefore, uniquely determine a chemical compound. The examples of 'isomerides' effectively illustrate the concept of *prabhāva*."

C. Dwarakanath: Fundamental Principles of Āyurveda : Part III, page 171.

2. (a) जिज्ञासूकण्ठस्थो जिह्वेन्द्रियस्थः सौम्यत्वात् सम्यग्प्रसङ्गान् वर्त्तते ।

Sūtrata : Sūtra 21 : 14.

- (b) रसबोधनात् । बोधको रसनास्थायी..... ।

Aṅgahārdaya : Sūtra 12 : 17.

Chart Furnishing Known Details of *Avasthāpāka*

(58)

Avasthā Pāka	Name of the <i>avayava</i> where secreted	Glands or cells	Vātā vyāpāra (Nervous control)	Activated by	Medium for work	Srāva nāma (Name of the secretion)	Substrate	Paripāma (End-Products)	Vipāka	Remarks
Madhura upto Ūrdhvaabhāga of Ūrdhva āmāśaya (Upper portion or fundus of the stomach)	Mukha (Buccal cavity)	1 Sub-maxillary 2 Sub-lingual 3 Parotid	Amśas (Portion) of prāna viz. 1. A branch from chordatympani (Parasympathetic) 2. Sympathetic from the plexuses around facial artery.	1 Darśana āśvādana and āghraṇa, etc. of food 2 Mānasika or Psychic	1 6.0 pH 2 45°C Temp.	1 Bodhaka Kapha (Mucin) 2 Pācaka Pitta (Ptylin or salivary amylase)	Cooked and uncooked starch	Soluble starch Erythro dextrin Maltose Achrode xtrin Maltose Soluble dextrin Maltose		Vidagdha or arha-pakva
Madhura in the upper portion (Fundus) and Amla in the body and lower portion (Pylorus), upto the end of Adhoāmāśaya (small intestine)	Ūrdhva-āmāśaya (Stomach)	1 Peptic 2 Oxyntic 3 Mucoid 4 Surface 5 Castle cells	Amśas (portion) of Samāna vāyu viz., 1 sympathetic from coeliac ganglion and 2 Parasympathetic from vagus (10th cranial) nerve	1 Reflex phase due to a. Psychic effect b. Distension of the stomach 2 Mechanical stimulation by the presence of food 3 Humoral phase 4 Presence of digestive products in duodenum 5 Chemically (Gastrin)	1 4-5 pH 2 37° c Temp 3 Presence of Hcl helps the function of pepsin	1 Kaledaka kapha 2 Rañjakapitta 3 Pācakapitta a Hcl (from oxyntic cells) b Renin c Lipase d Pepsin (from peptic cells)	Ingested diet cane sugar and other sugar, Soluble caseinogen, Fat 1 Protein 2 Collagen 3 Mucin 4 Nucleic acid	(Kledana-bhinnasamgata or disintegration) changes in structure by which other enzymes can act easily Insoluble caseinogen + calcium = Calcium caseinate Fatty acids and glycerol Acid metaprotein-proteoses and peptones Galactoses and gelatin peptones Peptonelike substance 1 Proteoses and peptones 2 Nucleic acid	Amla	Vidagdha " " " "
Amlapāka	Grahaṇī (Duodenum)	Agnyāśaya or Pancreas	Amśas (Portion) of Samāna vāyu viz., Sympathetic from Coeliac ganglion 2 Parasympathetic from Vagus. 3 Intrinsic nerves (Periferal Brain)	1 Reflex from the entrance of acidified chyme 2 Humoral a Secretin b Pancreozymin 3 Neural	1 6 pH 2 Trypsin is activated by entrokinase	Pācakapitta viz. 1 Trypsin (Proteinase) 2 Chemo Trypsin and carboxy peptidase. 3 Amylase 4 Lipase (Steap sin) 5 Milk curdling enzyme	1 Protein 2 Elastin 3 Proteoses and Peptones on starch, first acted by Hcl Fat Milk	Alkali-meta protein -deutro proteoses, -Peptone -peptone like substance Amino acids Dextrins Fatty acid and glycerol Curdles	Amla	Vidagdha

Avasthā Pāka	Name of the <i>avayava</i> where secreted	Glands or cells	Vāta vyāpāra (Nervous control)	Activated by	Medium for work	Srāva nāma (Name of the secretion)	Substrate	Pariṣāma (End-products)	Vipāka	Remarks
Amlapāka (contd)	Grahaṇī (Duodenum)	B Yakṛt (Liver) C Bruners glands of duodenal wall	Aśās (Portions) of Samāna Vāyu viz., Sympathetic and Parasympthetic	1. Neural 2. Chemically by chole-cystokinin		1. Pācakaṇṇa— a. Bile salts (Not an enzyme) b. Malaraṇṇa Pitta (Bile pigment) Ducrinin etc.*	Large fat droplets.	Emulsified fats (Small droplets)		Vidagdha
Amlapāka (contd)	Kṣudrānta (Small Intestine)	Crypts of Liver-kuhn	Aśās (Portions) of Samāna Vāyu. Viz, 1. Extrinsic A. Sympathetic B. Parasympathetic 2. Intrinsic A. Auerbach's plexus B. Miessner's plexus (Which form the Perifecal Brain)	1. Neural 2. Chemical like secretin. 3. Mechanical by presence of food and peristalsis	6. 3 to 8. 6 pH	Pācakaṇṇa viz. 1. Enterokinase 2. Erepsin 3. Invertase of Sucrase 4. Maltase 5. Lactase 6. Peptidase 7. Proteases 8. Lipase 9. Diaminase 10. Arginase 11. Nucleinase 12. Phosphatase	Helps trypsin to complete its work Cane sugar or Sucrose Maltose and Dextrose Lactose Peptones Proteoses Fat	Glucose and Fructose Glucose Glucose Amino acids Amino acids Fatty acid and Glycerol	Madhura Madhura Madhura Amla Amla Amla	
Kaṭupāka	Bṛhadanta or Large Intestine	From Bacteria	Aśās (portion) of Apāna Vāyu viz., 1. Extrinsic A. Sympathetic B. Parasympathetic 2. Intrinsic A. Meissners plexus B. Auerbach's " (But nerves are not responsible for Bacterial enzyme secretion)	1. Presence of food 2. Peristalsis	6. 9 to 7. 2 pH	Various Bacterial enzymes	Carbohydrate Cellulose Fat Proteins Alanin	Lactic acid-carbonic acid Sul-pide and Butyric acid. Carbonic acid + Methane Valeric and Butyric acid Peptones and Amino acids Ammonia, Indol and Skatol Ethylamine	Amla Kaṭu Amla Amla Kaṭu Kaṭu	

Foot Note :— * This Substance together with Anthelone and Villicrinin are found in the gastro-intestinal tract; but they are stated to be not well defined entities. West & Todd: Text Book of Biochemistry: 1955 edn: Page 1293.

can neither dissolve nor ionize cannot invoke the sensation of taste. It is obvious that, since *bodhaka kapha* is a variety of *kapha*, it should possess at least some of the invariable qualities of this *doṣa* viz. the *āpyagūṇa*. In addition, it should have the capacity to permeate through food and loosen the component particles, so that, they may go into solution.¹ The concept of *bodhaka* parallels the description of saliva, secreted by the salivary glands, especially paroteids, which abound in serous cells and which produces a thin watery secretion. It is of course, understood that, the mucus cells, especially, of the sublingual glands, provide a thick substance. These glands, also, provide the enzyme-ptylin. Thus, saliva, the analogue of *bodhaka* in *Āyurveda*, performs the following functions²—(i) it dissolves some substances, thus making taste possible; (ii) the enzyme content in it begins to act and (iii) it lubricates the food, so that it may be swallowed. The outcome of the action of *bodhaka* on food, especially that fraction of its composition which is essentially *madhura* in taste, is seen to be continued and completed in the upper portion of *ūrdhva ūmāśaya* described in the modern anatomy as the fundus of the stomach. By now, the insoluble *madhura* portion of food becomes sufficiently soluble and mixed up with the frothy *kledaka*

1. लालारूपो रसादिभेदान्विभजन् जिह्वारसं गृह्णाति ।

Āyurvedasūtra : Prāśna 1-81.

लालारूपो रसः जिह्वाग्रदक्षिणदार्शं गृह्णाति । भुक्तान्विभजनं च करोति इत्यर्थः ।

Yogānandanātha on the above.

2. It is seen that, even as early as the fifteenth century when *Yogānandanātha* is said to have written his commentary on *Āyurveda Sūtra*, *lāla* in the mouth, corresponding to *bodhaka kapha* (saliva), described by earlier authorities, perform two functions viz., it enables taste-perception and splits the food in the mouth. The former function was attributed by him to the *ap* or watery component of *lāla* and, the latter, to the potential *tejas* from which *ap* has been stated, by some of the *Darśanika* philosophies. Whatever the philosophical interpretation of this phenomenon may be, the fact remains that it was recognised by the medieval *Āyurvedic* authorities that saliva performs both the functions described above.

kapha (mucin) present in the *ūrdhva āmāsaya*. It is obvious that this fraction of the *ūhāra dravya*, which is meant to undergo *amlabhāva* remains in this stage still to be digested and it also becomes mixed up with *kledaka* which latter acts upon it and performs *klinna* (that is to say, it permeates through and loosens the particles.) The *madhura bhāva* of the *avasthāpāka* is now brought to an end, synchronising with the commencement of the second *avasthā*, namely, *amlabhāva*.

The entire movement of food from mouth to *āmāsaya* is due to the action of *prāṇavāyu*. According to Caraka,¹ Suśruta² and Vāgbhaṭa,³ functions of *prāṇavāyu* include the secretion and spitting of saliva (*ṣṭhivana*), eructation (*udgāra*) and deglutition (*annapraveśa*). The act of secretion of saliva, according to modern physiology, is due to the stimulation of sympathetic and parasympathetic.

The term *annapraveśa*, translated verbatim, means the entry of food into *āmāsaya* or, in other words, its propulsion into this organ, under the influence of *prāṇavāyu*. Stated in terms of modern physiology, actions ascribed to *prāṇavāyu*, which is stated to be located in the *mūrdhā* or head, resemble those of the autonomus nervous system in general, and parasympathetic in particular, even though the ancient *Āyurvedic* description includes some functions of the peripheral nervous system also. The deglutition centre is seen to be situated in the medulla-oblongata. These facts are in keeping with the description of *prāṇavāyu* and its location in the *mūrdhā* or head.⁴

The phenomenon of *amlabhāva* was discussed earlier in pages 39-41. This aspect of the *avasthāpāka*, can be seen from contributions made by modern physiology,

2. *Amla bhāva* to correspond to peptic digestion of proteins and it does not appear to have anything to do with the digestion of substances which possess *madhura*

1. धीवनक्षवभूद्गारभासाहारादि कर्म च । Caraka : Cikitsā 28 : 6.

2. सोऽन्नं प्रवेशयन्तः प्राणाश्चाप्यवलम्बते । Suśruta : Nidāna 1 : 13.

3. उरःकण्ठचरो बुद्धिहृदयेन्द्रियचित्तधृक् ।

धीवनक्षवभूद्गारनिःधासाक्षप्रवेशकृत् ॥ Aṣṭāṅgahṛdaya : Sūtra 12 : 4.

4. (a) प्राणोऽन्न मूर्धनः..... । Aṣṭāṅgahṛdaya : Sūtra 12 : 4.

(b) स्थानं प्राणस्य मूर्धोरः..... । Caraka : Cikitsā 28 : 6.

rasa viz. the carbohydrates. On the other hand, the insoluble proteins are digested, predominantly by the *amla* type of *srāva*, that occurs here, rendering this substance viz., proteins, soluble. At this stage, the food substances remain partly digested and partly undigested i.e., their digestion is still incomplete. This aspect was described earlier at page 38. It would appear that the *amlabhāva* of the *avasthāpāka*, is further continued under the influence of *jāṭharāgni*, resulting in the final breakdown—*bhinnasamghāta*—of various constituents of the food, which are meant to be absorbed from the *āmāsaya* into the system. Caraka says "The food that has reached *āmāsaya* or the seat of digestion, being fully digested, is distributed in its changed form to the entire body by means of *dhamanīs*.¹ The term '*dhamanī*' in this context obviously refers to blood vessels and lymphatics in the villi of the small intestine, through which the absorbed food is transported to the liver and cysterna chyli respectively, from whence, it is distributed to all the parts of the body through the circulating channels for providing nourishment to tissues.

Samāna Vāyu—A reference to *samāna vāyu* is necessary here, as this *vāyu* is stated to reside in and exercise control over intestinal digestion. According to Vāgbhaṭa, *samāna vāyu* is present near *agni* and it always moves throughout the *koṣṭha*. In addition, it is stated to enable the reception, digestion, separation and propulsion of food.² Functions similar to those of *samāna vāyu* are seen to be performed, for the most part, by the intrinsic nerves of the stomach and intestine. It has been shown by modern researches that numerous nerves are found in the walls of the stomach, intestine and oesophagus. Some of them have been shown to be the terminal fibres of the extrinsic nerves of these organs. These connect the gastro-intestinal tract anatomically and functionally with the brain and spinal cord. In addition to

1. आमालयगतः पाकमाहारः प्राप्य केवलम् ।

पक्वः सर्वाण्यं पश्चादमनोषिभिः प्रपद्यते ॥ Caraka : Vimāna 2 : 24.]

2. समानोऽग्निसमीपस्थः कोष्ठे चरति सर्वतः ।

अन्नं गृह्णाति पचति विवेचयति मुञ्चति ॥ Aṣṭāṅgahṛdaya : Sūtra 12 : 8

the above, it has been shown that these organs also have complete neurones especially beneath the mucosa and between the circular and longitudinal muscular layers. These neurones are shown to possess short dendrites and axons contained almost entirely within the walls of the tract. They make up a diffuse mesh-work of nerve tissue and serve as a kind of decentralised or "peripheral brain" by which the intestinal movements are controlled independent of the spinal cord and brain. These findings are based on experiments involving the severance of all the extrinsic neural connections of the stomach and intestines which slowed the digestive movements—peristalsis—though modified to some extent, still continue. In other words, as shown by Bayliss and Starling,¹ the section of the sympathetic and parasympathetic does not abolish the peristaltic movements but the application of cocaine to the lower wall results in the abolition of the intestinal movements. Thus, while enteric plexuses function in maintaining the rhythmic peristaltic movement along the digestive tract, the central nerves viz., the parasympathetic and sympathetic exert a regulating effect on gastro-intestinal peristalsis which is of utmost importance to the process of digestion, in the same way as the description of the influence exerted by *samāna* on the process of digestion, as described by *Āyurveda*.

Peristaltic waves mechanically break-up intestinal contents which are well macerated and thoroughly mixed up with the juice of the pancreas, liver and intestine. Further, as parts of semiliquid mass are brought into contact with the absorbing surfaces of the intestinal wall, absorption of the digested portion of the nutrition takes place. The above description will provide an explanation of the function of *samāna vāyu* ² viz. *annapacana* or enabling the digestion of food, *annavivecana* or the separation of the nutrient fraction from the fraction, which is still to be digested or if undigested the expulsion or *muhicana* of this fraction to the subsequent segments of the

2. Bayliss & Starling : J. Physiol, 1889, 24, 99; 1901, 26.

1. *Aṣṭāṅghaṛdaya* : Sūtra 12 : 3.

intestine where by churning movements followed by the peristaltic waves the process of digestion is continued without interruption, until, the finally digested residue is passed down in a semi-solid state into *pakvāsaya*.

The *pāka*, that takes place in the *pacyamānāsaya* and which results in the separation of the *sārabhāga* and its absorption into the body, and the propulsion of the *kṛtābhāga*, into the *pakvāsaya*, for further *pākas* is due to *jāṭharāgni vyāpāra*, and this description would appear to be a generalisation of the action or function of several substances, essentially conforming to the root meaning and definition of the term *pitta* viz., *pacana* and *paripamāna*. Substances referred to above, would appear to include *acchapitta*—a total concept—which comprises of several digestive secretions viz., liver-bile, pancreatic juice and intestinal secretions such as, *succus entericus* etc. Details of various constituents of the *jāṭharāgni* the substrate on which they act and the final outcome of the several reactions are furnished in the table at page 66a.

Further digestive events which take place in the *bṛhadantra* or *pakvāsaya*, as it is also known, has been succinctly described by Caraka in the following terms: "the

3. *Kaṭubhāva* material passed from *amāsaya*, having reached the *pakvāsaya*, being dried up by heat, is rendered into lumps. During this process, pungent (*kaṭu*) *vāyu* is produced.¹ Commenting on the above, Cakrapāṇi Datta has stated that by "*paripīṇḍita pakvāśya*" is meant the change to the form of lumps, in the process of formation of *mala*. By "*vāyuh syāt kaṭubhāvataḥ*" is meant, during the process of formation of lumps, pungent *vāyu* is produced.²

These observations find corroboration from modern researches, relating to the mode of formation of faeces, according

1. पकाशयं तु प्राप्तस्य शोष्यमाणस्य बद्धिना ।

परिपिण्डितपक्वस्य वायुः स्वात्कटुभावतः ॥ Caraka : Cikitsā 16 : 11.

2. परिपिण्डितपक्वस्येति परिपिण्डितरूपतया मलरूपतया पक्वस्य, 'वायुः स्वात्कटु-भावतः' इति परिपिण्डितावस्थोद्भूतकटुता वायोऽस्यव्यक्ते ।

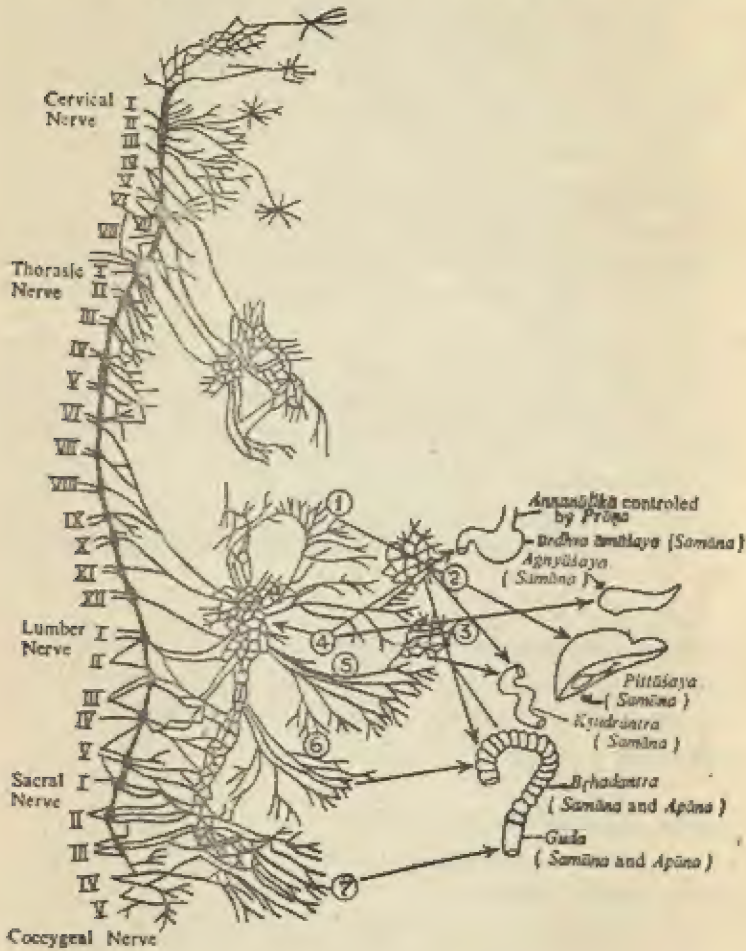
(Cakrapāṇi on above).

to which during the passage of intestinal contents through the small intestine the products of digestion along with many other compounds such as vitamins and mineral salts, are absorbed. As the contents reach large intestine, the process of absorption with the exception of water is normally completed. In the large intestine more water and salts are absorbed and the remaining material, now converted into faeces, leave the body. The consistency of the faeces depends to a large extent on the degree to which the process of absorption of water has been carried. It is to be noted that the consistency of the faeces also depends upon such factors as gastro-intestinal mobility and the nature of the diet ingested. Slight variation in diet apparently has little or no effect on the nature of the faeces. However, an exclusively vegetable diet, generally yields a larger bulk and softer consistency of faeces while a meat-diet produces harder faeces and less in quantity. The large intestine is the nidus of a large bacterial flora of which *Escheriachia coli* is ordinarily the predominant organism. These micro-organisms are shown to be involved in the alteration affecting products derived from the digestion of proteins. They are described as the putrifiactive flora which bring about the putrifaction of the protein residues of the food and the liberation in the process of various kinds of pungent gases with disagreeable and often foul odour such as indol, skatol, phenol, hydrogen sulphide and ammonia. Some of these organisms synthesise vitamins of the 'B' group. A part supply of this group is obtained from the intestinal bacteria and a part from outside sources. Thiamin is stated to be produced in unknown quantities by intestinal flora. The importance of B group vitamins to the integrity of the nervous system is now fully recognised.

The foregoing modern contribution are seen, not only to confirm but also amplify the ancient *Āyurvedic* version of events that take place in the large-intestine and the formation of faeces with the production of pungent *vāyu*. In addition, an explanation of the *Āyurvedic* view, that *pakvāsaya* is the *sthāna* or seat of *vāyu* also becomes intelligible in view of

VII

SCHEMA SHOWING VĀTAVYĀPĀRO
(SYMPATHETIC PORTION ONLY) OF MAHĀSROTAS



- (1) HEPATIC PLEXUS
- (2-3) AUERBACH AND MEISSNER'S PLEXUS
- (4) COELIAC PLEXUS
- (5) SUPERIOR MESENTERIC PLEXUS
- (6) INFERIOR MESENTERIC PLEXUS
- (7) HYPOGASPIC PLEXUS

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the important vitamins required for the wellbeing of the nervous system which are made available from this place.¹

Samāna and apāna vyūpāra, and pakvāśaya—

While *samāna* is stated always to move through the *koṣṭha*²—the latter term standing for *mahāsrotas*—*apāna* has been described by Suśruta as having its seat in the *pakvāśaya*³ and in this place, it is stated to move the *śakṛt* (faeces) downwards. As in the case of intrinsic nerves of the small intestine, the large-intestine also has two intrinsic nerve-plexuses. It is also enervated by both sympathetic and parasympathetic nerves. In other words, the proximal part of the colon is enervated by fibres derived from the superior mesenteric plexus, which is partly sympathetic (from the lumbar roots) and partly parasympathetic from the vagus. The distal part of the colon is enervated by sympathetic fibres which reach it from the upper lumbar roots viz. the pelvic splanchnic branches, inferior mesenteric plexus and nerves. The parasympathetic supply to the distal colon is from the 2nd to 4th sacral root by the way of the hypogastric plexus in which are also scattered ganglia to the wall of the colon.

1. The view that the *pakvāśaya* is the primary *sthāna* or site of *ajya* of the body, has a bearing on substances which are either available or produced here and which are necessary for the proper functioning of five varieties of *ajya*, is derived from the following reference :

वायुः पुनरग्नेराहारस्य च बह्व्यतया तस्मान्मुच्छन्नाविशेषादमूर्तः शब्दवानी-
यच्छब्दप्रचुरोऽल्पो वा पंचात्मा वायुः कोष्ठे प्रादुर्भवति ।

Aṣṭāṅgasaṃgraha : Śāstra : 6 : 67.

2. समानोऽग्निसमीपस्थः कोष्ठे चरति सर्वतः ।
अत्रं गुक्ताति पचति विवेचयति मुञ्चति ॥

Aṣṭāṅgahṛdaya : Sūtra 12 : 8.

3. पक्वाणालयोऽपानः काले कर्षति चाप्ययम् ।
समीरणं शक्यम् शुक्लगर्भात्तैवान्यथः ॥

Suśruta : Nidāna 1 : 19.

The intrinsic plexuses of the large intestine functions in the same manner as those of the small intestine do. As regards the action of the extrinsic nerves, there are different views held by different investigators. Says Lovatt Evans, "It has often been claimed that the sympathetic is inhibitory to the musculature of the colon, with the exception of the ileo-colic sphincter, to which it is motor, while the parasympathetic is motor to all, except the ileo-colic and anal sphincters. But there is doubt about the action of the sympathetic, which is without doubt, often motor, at all events to the circular coat, whether the vagus is motor to the caecum is, also, doubtful." ¹

Movements of large intestine comprise both peristaltic and churning movements. In addition, antiperistalsis, especially in the descending colon is stated to enable to slow the movement of the faecal matter downwards overcoming the influence of gravity.

Pressing the explanations furnished earlier as regards *samāna* in the *kṣudrāntṛa*, it may be said that *bṛhadantra* is also controlled by *samāna* while the predominantly parasympathetic (craniosacral) innervation will explain the influence of *apāna*.

In a brief review of the secretory activities of the *mahā-srotas* described under the heading *pitta* or *agni* it is necessary to note that the early observations made by Caraka about *madhurabhāva* and *amlabhāva* of the *avasthāpāka*, as well as the influence exerted by the *āhāra*, that has attained *amlabhāva* in the secretion of *accha pitta*, find experimental corroboration from the works of Povolv, Starling, Bayliss, Ivy and others, carried out since late nineties of the last century.

JĀṬHARĀGNI PĀKA

Even though the *āhārapācana*, discussed above, under *avasthāpāka*, is essentially *jāṭharāgnipāka*, a further reference

1. Lovatt Evans : Principles of Human Physiology : 11th Edn. page 906.

to this *pāka*, would appear to be necessary, before proceeding to an appraisal of *bhūtāgni* and *dhatvagni pākas*. From the point of view of *Āyurveda*, all *dravyas* and, in special, *āhāra-dravyas*, which possess six *rasas* viz. *madhura*, *amla*, *lavaṇa*, *kaṭu*, *tikta* and *kaṣāya*, when acted upon by *jāṭharāgni*, are stated to yield the following *rasas*, towards the end of *jāṭharāgnipāka* when the formation of *āhāra rasa* is stated to be completed.¹

Rasa	Caraka ²	Suśruta ³ quoting others' opinion	Aṣṭāṅga- Saṁgraha ⁴	Aṣṭāṅga- Hṛdaya ⁵	Pārā- śara ⁶ quoted in Saṁgraha	Āyurveda Sūtra ⁷
Madhura	Madhura	Madhura	Madhura	Madhura	Madhura	—
Amla	Amla	Amla	Amla	Amla	Amla	—
Lavaṇa	Madhura	Lavaṇa	Madhura	Madhura	Madhura	—
Kaṭu	Kaṭu	Kaṭu	Kaṭu	Kaṭu	Kaṭu	Lavaṇa
Tikta	Kaṭu	Tikta	Kaṭu	Kaṭu	Madhura	Madhura
Kaṣāya	Kaṭu	Kaṣāya	Kaṭu	Kaṭu	Madhura	Amla

(The *pākas* which *āhāra* and *auśadha dravyas* are stated

1. बाढरेणाग्निना योगाच्चदुदेति रसान्तरम् ।
रसानां परिणामान्ते स विपाक इति स्मृतः ॥ *Aṣṭāṅga-hṛdaya* : *Sūtra* 9 : 20.
2. कटुतिक्तकषायार्णां विपाकः प्रायशः कटुः ।
अम्लोऽम्लं पच्यते स्वादुर्मधुरं लवणस्तथा ॥
Caraka : *Sūtra* 26 : 58.
3. तत्राधुरन्ये प्रतिरसं पाक इति *Suśruta* : *Sūtra* 40 : 10.
4. विपाकस्तु प्रायः स्वादुः स्वादुलवणयोः अम्लोऽम्लस्य कटुरितरेषाम् ।
Aṣṭāṅgasamgraha : *Sūtra* 17.
5. स्वादुः पटुश्च मधुरमम्लोऽम्लं पच्यते रसः ।
तिक्तोषणकषायार्णां विपाकः प्रायशः कटुः ॥ *Aṣṭāṅga-hṛdaya* : *Sūtra* 9 : 21.
6. पाकाख्यो रसानामम्लोऽम्लं पच्यते, कटुः कटुकम् ।
चत्वारोऽन्ये मधुरं संकीर्णरसास्तु संकीर्णम् ॥
Pārāśara quoted in *Aṣṭāṅgasamgraha* : *Sūtra* 17.
7. तिक्तः स्वादुपाके, कषायोऽम्लरसः, ऊषणं लवणः पाके ।

to undergo, under the influence of *jāṭharāgnipāka* as described by various authorities, are furnished under their names in the tabular statement above).

It will be seen from the table above that there is a difference of opinion between Caraka and Suśruta¹ schools of thought about *vipākas*. According to the former, which have been followed by Vāgbhaṭa in his *Samgraha* and *Hṛdaya*, three *vipākas* viz., *madhura*, *amla* and *kaṣu* are seen to be described; whereas, according to the latter's view, which is followed by Bhadanta Nāgārjuna², there are only two *vipākas* viz., *madhura*, which is *guru* and, *kaṣu*, which is *laghu*. Gaṅgādhara Sena has suggested that Caraka's views on *vipāka* are based on the *rasa* of the *dravya*, whereas, according to Suśruta's school of thought, *vipāka* depends upon the alignment of the *pañcamahābhūtas* in *dravyas*.³

It is of interest to note that *Āyurveda Sūtra*,⁴ with a commentary by Yogānandanātha said to belong to the sixteenth century has described *vipāka* in a way not contemplated by the *vṛddhatrayī*, viz.,

- (a) *svādu vipāka* of *tiṭtarasa* ;
- (b) *amla vipāka* of *kaṣāyārāsa* ; and
- (c) *lavaṇa vipāka* of *kaṣurāsa*.

This work, according to authorities entitled to an opinion is stated to have been compiled on the basis of literature written

1. आगमे हि दिविष एव पाको मधुरः कटुकश्च । तयोर्मधुरास्यो गुरुः, कटुकास्यो लघुरिति ।

Suśruta : Sūtra 40 : 10.

2. द्वौ देविष्यदसंतात्परिणामस्य ।

Rasasañśepika : Sūtra 50.

3. इत्थं च रसविपाकाभिप्रायेण त्रिधापाक उक्तः । सुश्रुते भूतयुगपाकाभिप्रायेण विधापाकः उक्तः ।

Gaṅgādhara on Caraka : Sūtra 26 : 58.

4. *Āyurvedasūtra* with commentary by Yogānandanātha, Edited by Dr. R. Shama Sastry, Printed at Mysore Govt. Branch Press, 1922.

between first century B. C. and fifteenth century A. D. Though relatively recent, *Āyurvedasūtra* belongs to the late middle age and would represent a further stage of *Āyurvedic* development. In this sense, the views advanced by this work, mark a distinct advance over previous works and is, therefore, worthy of note.

The concept of *vipāka*, it is obvious, refers to the ultimate outcome of gastro-intestinal digestion, as could be judged from the *rasa* or taste of the final and products of origion, which, latter, is seen to be determined by the nature of their physico-chemical composition, as shown in the table below :

Rasas	Caraka ¹	Suśruta ²	Aṣṭāṅga- hṛdaya ³	Aṣṭāṅga- Saṁgraha ⁴	Rasa Vaiśeṣika ⁵
Madhura	Ap ⁶	Ap + Pṛthvī	Ap + Pṛthvī	Ap + Pṛthvī	Ap + Pṛthvī
Amla	Pṛthvī + Agni	Ap + Agni	Pṛthvī + Agni	Pṛthvī + Agni	Ap + Agni
Lavaṇa	Ap + Agni	Pṛthvī + Agni	Ap + Agni	Ap + Agni	Ap + Agni
Kaṭu	Agni + Vāyu	Agni + Vāyu	Agni + Vāyu	Agni + Vāyu	Agni + Vāyu
Tikta	Vāyu + Ākāśa	Vāyu + Ākāśa	Vāyu + Ākāśa	Vāyu + Ākāśa	Vāyu + Ākāśa
Kaṣāya	Vāyu + Pṛthvī	Vāyu + Pṛthvī	Vāyu + Pṛthvī	Vāyu + Pṛthvī	Vāyu + Pṛthvī

1. तेषां षण्णां रसानां सोमगुणातिरेकान्मधुरो रसः, पृथिव्यग्निगुणभूयिष्ठत्वाद्दम्लः, सलिलाग्निभूयिष्ठत्वाल्लवणः, वाय्वग्निगुणभूयिष्ठत्वात्कटुकः, वाय्वाकाशान्तिरेकत्वात्तिक्तः, पवनपृथिव्यतिरेकात्कषायः इति । *Caraka : Sūtra* 26 : 40.
2. भूम्यम्बुगुणबाहुल्यान्मधुरः भूम्यग्निगुणबाहुल्याद्दम्लः, तोयाग्निगुणबाहुल्याल्लवणः, वाय्वग्निगुणबाहुल्यात्कटुकः वाय्वाकाशगुणबाहुल्यात्तिक्तः पृथिव्यनिलगुणबाहुल्यात्कषाय इति । *Suśruta : Sūtra* 42 : 3.
3. स्मान्मोऽग्निस्मान्मुतेजः स्रवाय्वनिलगोऽनिलैः ।
द्वयोस्वग्नैः क्रमाद्भूतैर्मधुरादिरसोद्भवः ॥ *Aṣṭāṅgahṛdaya : Sūtra* 10 : 1.
4. *Aṣṭāṅgasamgraha : Sūtra* 18.
5. *Rasavaiśeṣika : Adhyāya* 3 : *Sūtra* 38-43.
6. पृथिवो सोमगुणातिरेकान्मधुरो रसः ।

Text according to Yogendranātha Sena.

As pointed out earlier, *jāṭharāgni vipāka* of *āhāra*, which latter is made up of substances possessing six different *rasas*, do not apparently undergo any chemical change. By implication, they undergo physical change only as can be seen from the fact that *dravyas* with *madhura rasa* are stated to undergo *madhura vipāka* i.e., their original *bhautic* composition is not destroyed. It must be noted here that generally glucose and its polymers are absorbed as such from the small intestine. Some portion of the carbohydrate of the diet is also seen to be "broken down to acids such as butyric acid and lactic acid, which give the ideal content a reaction which is acid."¹ Similar is the case with *amladravyas*. In the case of *lavaṇa*, there is, however, a suggestion of some change in the constitution of the compound itself, leading to *madhura vipāka*. This may, possibly, be explained by the fact that, with the dissociation of chlorine ions from sodium chloride in solution, the positive sodium ion is left behind. Moncrieff² in his "Chemical Senses" has quoted Kahlenberg as having shown "that the saline taste of sodium chloride is due to Cl^- ions. It has been determined by the fact that NaCl should be more completely dissociated than sodium acetate and that, the concentration of Na^+ ions in the sodium chloride solution would be greater than the sodium acetate solution. The taste of a molecule of sodium acetate is changed by the dissociation of acetate. Hence, the saline taste of NaCl is attributed to Cl^- in the molecule." It will follow from this that the heavier Na^+ fraction may have a taste of its own and the possibility that it may be sweetish can not be ruled out. *Kaṭu* remains *kaṭu*, while the claim that *kaṣāya* and *tikta* undergo *kaṭu vipāka*, under the influence of *jāṭharāgni* involving a change in their composition leading *pari passu* to a change in their *rasa* awaits corroboration. The foregoing can be represented as follows on the basis of data furnished by modern physiology and bio-chemistry including pharmacology :

1. Leon Schiff; Pathologic Physiology : p. 278, 1951 Edn.
2. Kahlenberg, Bull, University of Wisconsin, quoted by Moncrieff in his "Chemical Senses" page 136, (1951 Edition).

- | | |
|--|---|
| (A) <i>Madhura</i> —generally carbohydrate | $\left\{ \begin{array}{l} (a) \text{ } \textit{Madhura} \text{ as glucose and its isomers} \\ (b) \text{ } \textit{Amla} \text{ as lactic acid and butyric acid.} \end{array} \right.$ |
| (B) <i>Amla</i> —mainly organic acids like lactic, butyric, acetic, citric and tartaric and malic acids. | $\left\{ \begin{array}{l} \textit{Amla}—lactic, butyric acetic, citric, tartaric acid. \end{array} \right.$ |
| (C) <i>Lavaṇa</i> —mainly Sodium Chloride—NaCl | $\left\{ \begin{array}{l} \text{Na}^+ + \text{Cl}^- \\ \text{Na}^+ \rightarrow \textit{Madhura} (?) \end{array} \right.$ |
| (D) <i>Kaṭu</i>
(E) <i>Tikta</i>
(F) <i>Kaṣāya</i> | $\left\{ \begin{array}{l} \text{That, substances possessing these tastes, undergo a change by which their } \textit{vipāka} \text{ is rendered } \textit{kaṭu} \text{ should await scientific evidence.} \end{array} \right.$ |

It would now seem that *lavaṇa vipāka*, as an additional *vipāka*, may have to be added to the three already furnished by *Vṛddhatrayi*. Theoretically speaking, the principle, "as the molecular weight increases there is a gradual change in the taste of salts from saline to bitter and lower molecules of the homologous series will be sweet and higher members bitter"¹ may have an application to the *tikta dravyas* that are stated to undergo *madhura vipāka* by *Āyurveda Sūtra*. The example of saccharine can be cited in support of this view. This substance, in its pure form, is bitter but, when broken down to molecules of smaller size in solution it is seen to be sweet and *vice versa*. The group of substances which possess *tikta rasa* to begin with and attain *madhura vipāka*, under the influence of *jāṭharāgni*, can be expected to have

1. Moncrieff : Chemical Sense : 1951 Edn. p. 147.

been broken down to molecules of lesser weight, thus releasing *madhura rasa*.¹

The question, if *kaṣāya rasa* can yield *amla rasa*, awaits further study.

Summing up: The efficient conduct of *jāṭharāgni pāka* results in the conversion of complex food substances into their 'elemental forms' which are separated from the undigested fraction. The former is taken up for further chemical reactions before they are rendered fit for metabolic reactions.

Substances, which are of immediate interest and which are utilised in large quantities, in diet, relate in the order of importance and quantity, to *madhura*, *amla* and *lavaṇa* groups. The quantity of substances which possess *kaṣu*, *tikta* and *kaṣāya* in an average Indian diet are relatively insignificant even though in certain parts of India especially in Andhra and Orissa *kaṣu dravyas* are also utilised in respectable quantities as a part of normal diet.

BHŪTĀGNI PĀKA

Both Caraka and Vāgbhaṭa have made direct references to *bhūtagnipāka* while, Suśruta has made an indirect mention of it. According to Caraka², the digestion of food by *jāṭharāgni*, results in the breakdown of food into five distinct physico-chemical groups viz., *pārthiva*, *āpya*, *taijasa*, *vāyavya* and *nābhasa* (The classification of dravyas under fivefold *bhūta* group is based upon certain physico-chemical properties

1. An example of change from sweet to bitter on ascending homologous series, are the betines of amino acids. Khun *et al* showed that, while valerobetine and caprobetine have transient sweet taste, the betine to amino-penta-dicyclic acid was bitter. Khun & Girol : 3 Physiol : Chemic, 231 : 208-209.

2. भौमाप्याग्नेयवाय्वाः पञ्चोष्माणः सनामसाः ।

चैवाहारशुणान् स्वान्त्वान्पार्थिवान् पचन्ति हि ॥

Caraka : Cikitsā 15 : 13.

or qualities ascribed to each *bhūta* class)¹ *Jāṭharāgni* is stated to ignite the *agni* fraction present in each of the five groups. This *agni* moiety is then said to digest the substance of that group (leading to a radical change in its qualities—*vilakṣaṇa guṇa*²), which renders food substances fit for being assimilated into and built up as parts of corresponding *bhūta* class of substances present in the *dhātus* after the same has been subjected to the action of *dhātvagnis*.

According to Suśruta "the animated human organism is composed of five *mahābhūtas* and the food of a living organic being, necessarily partakes the qualities of its corporeal components. The food which consists of five *mahābhūtas* is digested in its turn by the five *bhūtagnis* and each of its principle proceed to augment its own homologue in the human organism."³

Events, described in the references cited above obviously occur after the ingested food has been suitably dealt with in *jāṭharāgni pāka*, leading to the reduction of the basic food stuffs into their elemental forms.⁴ The latter are classed on the basis of their physico-chemical properties under five

1. (a) तत्र द्रव्याणि गुरुस्वरकठिनमन्दस्थिरविशदसान्द्रस्यूक्तगन्धगुणबहुलानि पाथि-
वानि, द्रवस्निग्धशीतमन्दसरसान्द्रमृदुपिच्छिलरसगुणबहुलानि आप्यानि,
उष्णतीक्ष्णसूक्ष्मलघुकृक्षविशदरूपगुणबहुलानि आग्नेयानि, लघुशीतकृक्ष-
स्वरविशदसूक्ष्मस्पर्शगुणबहुलानि वायव्यानि...।

Caraka : Sūtra 26 : 11.

(b) *Aṣṭhāṅghrdaya* : Sūtra 9 : 6-8.

(c) *Suśruta* : Sūtra 41 : 4.

2. भौमादयः पञ्चोष्माणः पाथिवादिद्रव्यव्यवस्थिता जाठराग्निसंघुक्षितबला
अन्तरीयं द्रव्यं पचन्तः स्वान् स्वान् पाथिवादोन् पूर्वपाथिवगन्धस्वाधविलक्षणान्
गुणान् निर्बर्तयन्ति ।

Cakrapāṇi on Caraka : Cikitsā 15 : 13.

3. पंचभूतात्मके देहे जाहारः पंचमौलिकः ।
विपकः पंचधा सम्यग् गुणान्स्वानभिवर्धयेत् ॥

Suśruta : Sūtra 46 : 526.

4. जाठरेणाग्निना पूर्वकृते संपातभेदे पश्चाद्भूतात्मयः पंच स्वं स्वं द्रव्यं पचन्ति ।

Cakrapāṇi on Caraka : Cikitsā 15 : 13.

bhautic groups viz., *pārthiva*, *āpya*, *āgneya*, *vāyavya* and *nābhasa*. It would seem that the ultimate products of *jātharāgnipāka* are suitably processed by *bhūtagñipāka*, which are now fit to be acted upon by the specific *agni* associated with each one of the seven *dhātus*, before they are finally synthesised as a part of the latter.

The foregoing description of *bhūtagñipāka* resembles the description of auto digestion, comparable to anaerobic reactions. This step would seem to be necessary, as the food consumed are foreign to the body i.e. *vijātiya* and unless they are suitably processed they may not be converted as organism-specific i.e. *sajātiya* substances. This can be illustrated with the example of starches, fats and proteins of the food which by the process of digestion are rendered fit to be re-synthesised as organism specific carbohydrate, fat and proteins. Thus, vegetable starch or cellulose is first broken down to its elemental form i.e. glucose and its polymers towards the end of the intestinal digestion before they are again rebuilt in the body as organism—specific animal starch or glycogen. Likewise, fats derived from plants and animals are broken down during the process of digestion to their elemental forms viz. fatty acids and glycerols before they are rebuilt in the body as organism-specific lipids. The same is the case with proteins—vegetable and animal—also. These are broken down into their elemental forms viz. amino acids before they are synthesised as organism-specific proteins viz., albumen, fibrinogen, most of the globulins and non-essential amino-acids.

It would, seem that *bhūtagñipāka* takes place in the *adha-āmāśaya* itself but speaking factually, it would appear from the available description of this *pāka*, that it resembles in some respects events which take place in the small intestine and, in others in the liver. It was shown elsewhere that *yakṛt* or liver itself is anatomically and functionally related to *koṣṭha*. Hence, it may be possited that the *bhūtagñipāka*, which is commenced in the *adha-āmāśaya*, is continued and completed in the *yakṛt*.

Āhāra representing *śaḍrasas* in proper proportion (balanced diet)

- I Stage—*Madhura bhāva* (*Ūrdhva āmāśaya* or stomach in the fundus—starch digestion)
 II Stage—*Amla bhāva* (*Ūrdhva āmāśaya* in the body and pylorus of the stomach—protein digestion—formation of peptones and acidified chyme)
Pācākāgni (*Jāṭharāgni*)—passage of the gastric digest (acidified chyme) to *adhā āmāśaya* (*kṣudrāntṛa*) resulting in the discharge, in this place of *acchapitta* and its action on chyme.

Sāra (representing the ultimate elemental forms of the foods ingested—described on the basis of their physico-chemical qualities)—*vijātīya*

Kitta

in *pakvaśaya* where separation of substances meant to be eliminated through *mūtra*, *purīṣa* takes place; *Plūḍhika-rāga*; formation of *malārūpa vāyu* with pungent and disagreeable odour and the production of substances required for the five *vāyus*

III Stage—*Bhūtagni Pāka*

<i>Parthiva</i>	<i>Āpya</i>	<i>Taijasa</i>	<i>Vāyavya</i>	<i>Nabhasa</i>
+	+	+	+	+
<i>Parthiva</i>	<i>Āpya</i>	<i>Taijasa</i>	<i>Vāyavya</i>	<i>Nabhasa</i>
<i>agni</i>	<i>agni</i>	<i>agni</i>	<i>agni</i>	<i>agni</i>

Indhatvagni Pāka

Upādāna and *ammarasa* for utilisation for the production of *Sajātīya*

<i>Parthiva</i>	<i>Āpya</i>	<i>Āgneya</i>	<i>Vāyavya</i>	<i>Nabhasa</i>
Structural constituents of the body Proteins etc.	Body fluids	Enzymes; metals and minerals like Fe, Cu, Co, Mg, Mn, Mo, Ca, K, Na, Cl, I etc. & many energy locked substances eg. phosphorus linked sugars vitamins (coenzymes), some hormones like thyroxin.	constituents required for the synthesis of neural structures and certain hormones like acetyl choline and sympathin etc.	?

The foregoing description of *bhūtāgnipāka* is based on *Carakasamhitā*. Vāgbhaṭa in his *Samgraha*¹ and *Hṛdaya*² has clearly described the steps leading to *bhūtāgnipāka* and in his view, the separation of *sāra* from *kiṭṭa*, takes place after the completion of *bhūtāgnipāka*.

A careful study of the works of both Caraka and Vāgbhaṭa shows that the formation of *sāra* and the separation of *kiṭṭa* occur towards the end of *Avasthāpāka*, *jāṭharāgni* and *bhūtāgnipākas* which by implication would appear to take place in the terminal portions of the ileum. But available experimental evidences and observations show that as digestion of different compounds of food viz., proteins, fats and carbohydrates are completed, absorption of the digested fraction takes place almost immediately, the undigested portion being taken over for further reactions as it passes down. It would, therefore, seem that the process of digestion and absorption follow each other very closely throughout the entire length of *kṣudrāntṛa* and, by the time, the food reaches the cecum, hardly any digestable component of it is left. The portion that passes through the cecum represents, for the most part undigested cellulose. If these observations are to be extended and applied to the *jāṭharāgni* and *bhūtāgni pākas* then *jāṭharāgnipāka* of the *āharadravyas*, should be immediately followed by *bhūtāgni pāka*, resulting in the separation of *sāra* and its absorption immediately the *kiṭṭa* being moved further

1. ततश्चैव विच्छिन्न आहारं पंच पंचात्मका महाभूताग्रयो वायुना व्यस्तान् यथास्वं पञ्चैव भूतगुणानाहारस्थान् पचन्ति । ते पकाः पुनर्यथास्वमेव देहाश्रिताश्च स्वविकारभूतान् भूतगुणानाप्याययन्ति ।

एवं च पक्वादाहारादिविषयैषमगमादिव स्नेहादच्छः सारभूतो रसाख्यः किट्टाख्यश्च मलोमिविवर्तते । *Aṣṭāṅgasaṁgraha : Sūtra 6 : 59-60.*

2. भौमाप्याग्नेयवायव्याः पंचोष्माणः सनामसाः । पंचाहारगुणान् स्वान् स्वान् पार्थिवादीन् पचत्वनु ॥ यथास्वं ते च पुष्पन्ति पक्वाः भूतगुणान् पृथक् । पार्थिवाः पार्थिवानेव शेषाः शेषाश्च देहगान् ॥ किट्टः सारश्च तत्पक्वमन्नं सम्भवति दिष्टा । तत्राच्छं किट्टमन्नस्य मूर्धं विद्याद्वनं शक्य ॥

Aṣṭāṅgahṛdaya : Sūtra 3 : 59-61.

down where the process repeats itself, until hardly anything of *sāra* is left. In this view, the two processes—*jāṭharāgni* and *bhūtāgni vyāpūras* are concurrent ones.

ANNAVAHA-SROTĀMSI

A reference to *annavahasrotas* would appear to be necessary at this stage. It may be recalled that, the terms *mahāsrotas*, *koṣṭha*, *āmāśaya*, *pakvāśaya*, *kṣudrānta*, *bṛhadantra* etc., were used to designate the gastro-intestinal tract with which the *jāṭharāgni* and *bhūtāgnis* are intimately concerned. The use of the term *annavahasrotas* has also a relevance to the structure mentioned above. This term actually means the *srotas* that conducts *anna* i.e., the conduit or channel through which food is conducted. The term *srotas* at the macroscopic level means a conduit or channel and this term is applicable to varieties of structures such as the tubular system through which blood is conducted—the vascular system; the respiratory passages which conduct air; the lymph channels which conduct lymph, the neural pathways through which nerve impulse flows and the digestive tube through which food passes. All these represent the grosser types of *srotāmsi*. Each one of them, in its turn, is composed of subtle or extremely fine *srotāmsi*, through which various kinds of substances are exchanged from the outside environment with the inside. It may be noted that according to Caraka, all conduits or channels of transport—grosser or subtler—such as *sirā* (vein), *dhamanī* (artery), *rasāyanī* (ducts in general and lymphatics in particular), *rasavāhini* (capillary), *nāḍī* (tubes), *panthā* (passage), *mārga* (pathway), *śarīracchidra* (various opening), *saṁvṛtāsāṁṛta* (different kinds of glands some open and others close), *sthāna* (location), *āśaya* (organ), *niketa* (repertory) are to be deemed as *srotāmsi*;¹ whereas, according to Suśruta "Srotāmsi are channels which have their origin in an organ cavity and spread throughout the body conducting *rasādi*

1. स्रोतांसि, सिराः, धमन्यः, रसायन्यः, रसवाहिन्यः, नाड्यः, पन्थानः, मार्गाः, शरीरच्छिद्राणि संवृतासंवृतानि, स्थानानि, आशयाः, क्षयाः, निकेताथेति शरीर-धात्वकाशानां रुद्ध्यालक्ष्याणां नामानि भवन्ति । Caraka : Vimāna 5 : 9.

dhātus. These are different from *sirās* (veins) and *dhamanīs* (arteries) which may otherwise resemble them.”¹

The term *srotas* is self explanatory, that it is defined as *śravaṇāt srotāṁsi*², meaning *srotas* is so called because of *śravaṇa*. *Śravaṇa* means “to exudate” “to transude,” “to permeate” or “to filter through.” The implications of *srotāṁsi* have been examined by Caraka and they are (a) structures through which *śravaṇa* (oozing, exudation or filtration of fluids) occurs; (b) these are channels through which body fluids are transported from place to place. Another implication, perhaps a significant one of this term as described by Caraka is that *srotāṁsi* are *ayanamukhas*,³ that is to say, the channels are themselves entrances. This has reference to the function, *srotāṁsi* performs, viz., the transport of nutrients or *prasāda* to and waste products or *malas* from the *dhātus* and *āśayas*. Clarifying the implication of the above, Cakrapāṇi Datta⁴ has offered two explanations, viz., (a) the term *ayanāni* refers to channels through which something travels and (b) *mukhāni* places of entry through which something enters. Therefore, the channels and entrances of *dhātus* and *malas* are not distinct and different entities and the same channel serves both as vehicle for the conduct of *prasāda* and *mala* and they also serve the purpose of the ingress egress of these two substances. As will be discussed at a later stage, the *srotāṁsi* as described above by Caraka and commented upon by Cakrapāṇi Datta would refer to the capillary system which serve twofold purposes viz. *ayanāni* and *ayanamukhāni*.

Extending the foregoing explanations and clarifications to the *annavaha srotas* with which this thesis is concerned this

1. मूलान् स्रवन्तरं देहे प्रसृतस्त्वभिवाहि यत् ।
स्रोतस्तदिति विज्ञेयं सिराधमनिवर्जितम् ॥ *Suśruta : Śāstra* 9 : 13.
2. धमानादमन्यः, स्रवणात्स्रोतांसि, सरणात्सिराः । *Caraka : Sūtra* 30 : 12.
3. तेषां तु खलु मलप्रसादाशयानां वातूनां स्रोतांस्त्वयनमुखानि ।

Caraka : Sūtra 28 : 5.

4. अयनानि च तानि मुखानि इति अयनमुखानि । अत्र च आधान्वयनेन इति

VIII ANNAVAHA SROTAS



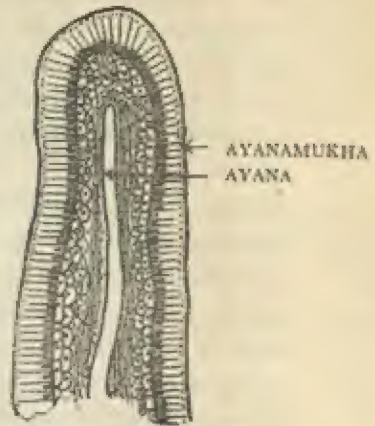
RASĀŅKURA
(VILLUS)

DUODENAL
GLANDS

PLĀṂSAPEŚI
Circular

MĀṂSAPEŚI
Longipidinal

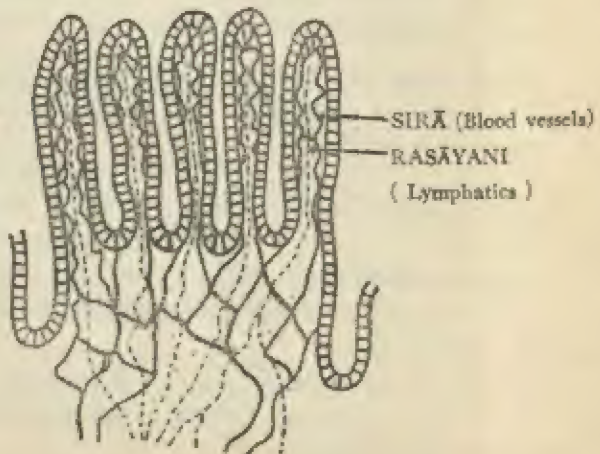
SECTION OF KṢUDRĀNṬRA
(ONE PART OF MAHĀSROTAS)



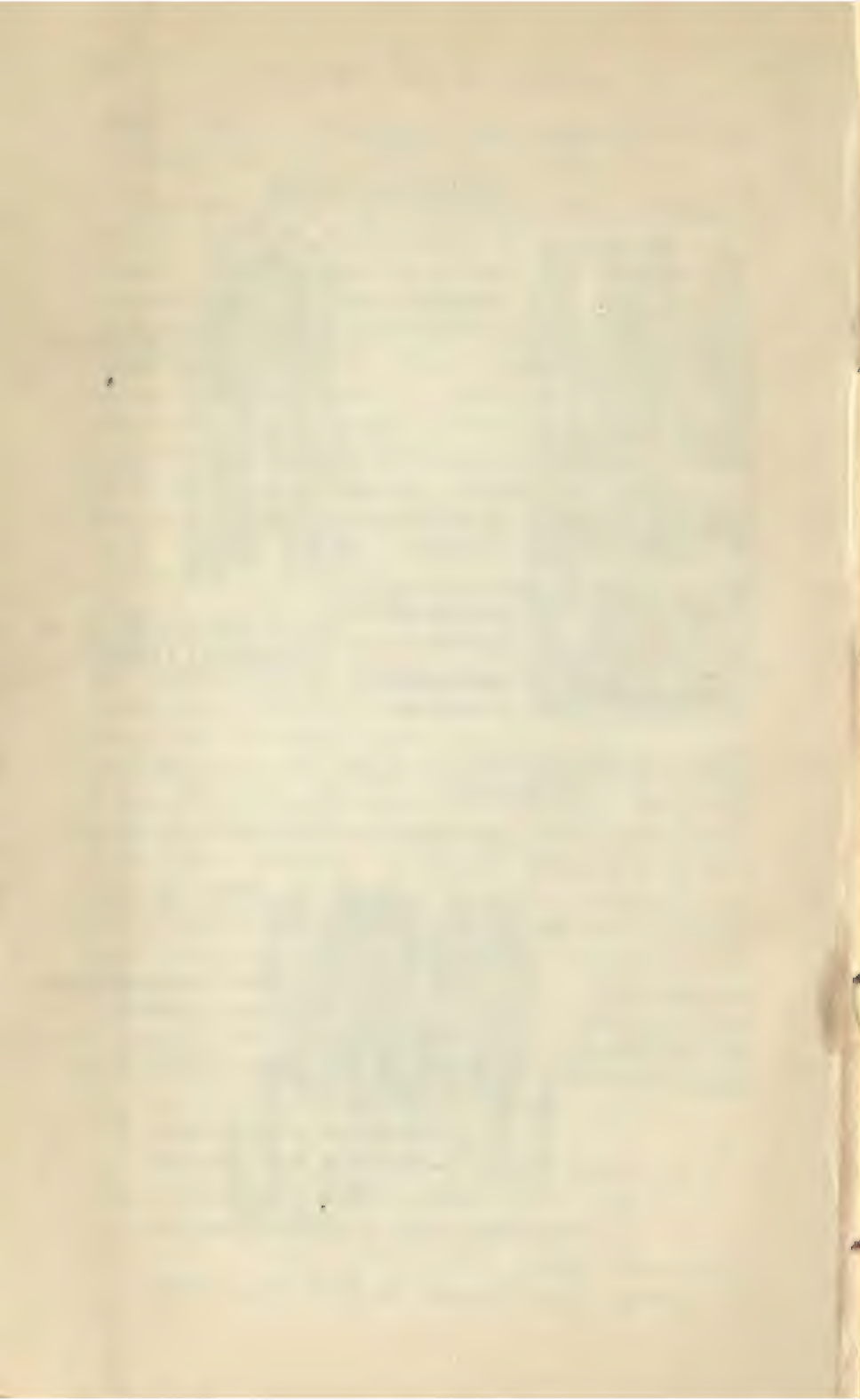
AYANAMUKHA
AVANA

LONGITUDINAL SECTION OF
RASĀŅKURA (VILLUS)

SECTION OF KṢU-
DRĀNṬRA WITH
ANNARASAVAHĀ
DHAMANI



SIRĀ (Blood vessels)
RASĀYANI
(Lymphatics)



srotas is the long tube commencing from the mouth and ending with the anus through which food is propelled and in which it is digested and also the villi which line the inside of this tube through which the *sāra* or the digested fraction of the food is absorbed and made over to the portal vein and thoracic duct for being transported to appropriate places where they may be dealt with by further *pākas*. Caraka has made a clear reference to the channels through which digested food is absorbed and distributed throughout the body as *dhamanī*, present in the *āmāśaya*.¹ The term *dhamanī*, as in the case of *sirā*, refers to blood vessels through which the absorbed food material is transported (regardless of the distinction, made between *dhamanī* and *sirā* which, in certain circumstances, are found to pertain to the same structure.²) Thus, while the *mahāsrotas* in its grosser aspect represents the gastro-intestinal tract, the intestinal villi represent the subtler units of *srotāmsi* which compose the former.

YAKṚT AND ANNAVAHA SROTAS

It may also be mentioned here that *yakṛt* which, as pointed out in page No. 77, represents, in adult life an extension of the *ūrdhvaabhāga* of the *adhā āmāśaya* or *grahantī*, is, itself an organ, composed exclusively of *srotāmsi*. The existing editions of *Āyurvedic* classics, have recognized this organ as the *mūla* or root of *raktavaha srotāmsi*³ and the *sthāna* of *rakta*⁴ and *rañjaka pitta*.⁵ From the point of view of advances made

अयनानि मार्गाणि, मुखानि तु येः प्रविशन्ति । एतेन मलानां धातूनां च
यदेवायनं तदेव प्रवेशमुल्लमिति नान्येन प्रवेशे नान्येन गमनमित्युक्तं भवति ।

Cakrapāṇi on the above.

1. आमाशयगतः पाकमाहारः प्राप्य केवलम् ।
पक्वः सर्वशयः पश्चादमनीभिः प्रपद्यते ॥ Caraka : Vimāna 2 : 18.
2. Caraka : Vimāna 5 : 9.
3. (a) शोणितवहानां स्रोतसां यकृन्मूलं श्लोहा च । Caraka : Vimāna 5 : 8.
(b) रक्तवहे द्वे, तयोर्मूलं यकृत्श्लोहानौ रक्तवाहिन्यश्च धमन्यः ।

Suśruta : Śāstra 9 : 12.

4. शोणितस्य स्थानं यकृत्श्लोहानौ । Suśruta : Śūtra 21 : 16.
5. यत्तु यकृत्श्लोहोः पित्तं तस्मिन् रजकोऽभिरिति संज्ञा ।

Suśruta : Śūtra 21 : 10.

by modern medical science *yakṛt* is seen not only to be the *sthāna* of *rakta* and *rahjaka pitta*, but also an organ immediately concerned with intermediary metabolism contributing as will be shown at a later stage, to *dhātvaṅni vyūpāras*. It is thus seen that "Liver is immediately concerned with carbohydrate, lipid and protein metabolism. In so far as the carbohydrate metabolism is concerned, it converts glucose to glycogen; segments of the carbon skeleton of a portion of the total amino acids metabolised in the body are converted into substances which, in turn, may be employed in glucose and glycogen synthesis—*gluco-neo-genesis*. Fatty acids are re-synthesised, *de novo*, in this organ and released to circulation for being deposited in the adipose tissues. Here also fatty acids of the diet are transformed into a mixture, more closely resembling that of the species. From lipids also the liver re-synthesises cholesterol and esters. In the course of its steroid metabolism the liver elaborates cholic acid and couples it with glycine and taurine to make the bile acids. In addition, the steroids elaborated by various endocrine glands undergo metabolic transformations. As regards protein metabolism, the liver fabricates the non-essential amino acids by employing nitrogen, either from other amino acids or from ammonia. Numerous other nitrogenous materials are synthesised in the liver—ethanalomine, creatine, choline, purines and pyrimidins. Moreover, it is in the liver, that the final steps of the nitrogen metabolism occur, with the formation of urica and uric acid in man. In addition to its activities, in the metabolism of individual amino-acids, liver also fabricates a number of plasma proteins, including albumin, fibrinogen, prothrombin and a major portion of globulins. The cells of this organ contain a significant amount of readily metabolisable protein, in the sense that, upon fasting or an ingestion of protein-free diet, proteins from the liver are rapidly utilised during the period of negative nitrogen balance.

The liver is the site of most of these reactions which involve alteration of foreign compounds which can be mobilised. These reactions include the acetylation of aliphatic and aromatic amines, methylation of mercapturic acid

and hippuric acid, synthesis, oxidation and glucoronide and etherial sulphate formation. Substances, other than glycogen are stored in the liver. These include iron as ferritin and lipid soluble vitamin.

Finally, there is the secretory role of the liver, concerned with the formation of bile. In this role, the liver prepares the bile salts, separates bilirubin from proteins with which it is associated in the plasma, resynthesises cholesterol and pours these with other bile components into the biliary capillaries and thence, via the connecting ducts to the gall bladder. This has also proved to be the route for the excretion of serum phosphatase."¹

It will be seen from the foregoing that *yakṛt* or liver has not only inherited some of the functions of *grahāṇī*—the duodenum in particular—but has also, extended the *agni* function of *grahāṇī*, to a high degree of specialisation. If the function of the *grahāṇī*-based *pācākāgni* is of the nature of *vibhāga* or *bhinnasaṁghāta* of the *āhāra dravyas*, the *yakṛt* possesses in addition the function of *saṁyoga* or synthesis. In other words, the *pāka* that takes place in *yakṛt* is both of the *vibhāga* and *saṁyoga* types. It would, therefore, be necessary to take note of *yakṛt*, in connection with the study of *dhātvaṇi pāka*. The need for doing so becomes emphasised, in view of the fact that *āhāra rasa*, absorbed from the *adha-āmāśaya*, through the subtler *annavaha srotāṁsi* corresponding to villi has been shown to be transported to the *yakṛt*, through two channels viz., *pratihārīṇīśīrā* or portal vein, directly and *rasapropā* or thoracic duct, indirectly, for further *pākas*. If this is not done, the phenomena of *dhātvaṇi pāka* and subsequent events may remain unexplained.

DHĀTVAGNI-PĀKY

By the term *dhātvaṇi pāka* is meant, chemical reactions to which the *āhāra rasa* absorbed from the *adha-āmāśaya* is subjected to before it is utilised by the *poṣya* or the *sthāyi*

1. Principles of Bio-chemistry by Abraham White *et al*, pp. 858-59. Mc Graw Hill Publication : 1954 edition.

dhātus, present in all parts of the body. The term *dhātvaṅni* refers to *agnis* or *pittas*, which take part in *pākas*, than occur from *yakṣt* onwards. Seven different kinds of *dhātvaṅnis* corresponding to seven species of *dhātus* have been envisaged by *Āyurveda*. They are *rasāgni*, *raktāgni*, *māmsāgni*, *medogṇi*, *asthyāgni*, *majjāgni* and *śukrāgni*. These *agnis* are stated to mediate or catalyse metabolic transformations of nutrient substances before they are supplied to the seven species of *dhātus* viz., *rasa* (plasma, tissue fluid, and lymph), *rakta* (the elements of the blood which are red in colour and which float in and circulate with *rasa dhātu*), *māmsa* (muscle tissue), *medas* (adipose tissue), *asthi* (bone including the cartilage tissue), *majjā* (yellow or red bone marrow or the marrow tissue) and *śukra* (the male reproductive element) through their respective specific *srotāṁsi*. Says Caraka "nutrient substances, that support the body, are subjected to *pāka* again, being acted upon by the seven *dhātvaṅnis*, giving rise to two kinds of substances viz., *kṛtṣa* and *prasāda*." ¹ "Nutritional substances, that nourish the *dhātus*, undergo *pāka* by the *līṣmā* (*agni*) of the *dhātus* and then, they are made available to the latter, through this respective *srotāṁsi*." ²

Earlier, in the chapter on *Vividhāṣitapittiya* of the *sūtra-sthāna* of his *saṁhitā*, Caraka has observed that the wholesome foodstuff ingested in fourfold manner, having been digested by *antarāgni*, is followed by further *pākas*, under the influence of *bhūtāgni* which latter have been duly ignited by the former *agni* which again are subjected to further *pākas* by *dhātvaṅnis*, subject to the condition that the *dhātvaṅmā* (*dhātvaṅni*), *dhātuvaha srotāṁsi* and *māruta*, are not impaired and *dhātu pāka* is proceeded with as inexorably as *kāla*. *Dhātuvāhāras* thus prepared confer upon the organism strength, complexion, happiness, longevity and provide energy to the *dhātus*. The

1. समभिर्देहभक्षारो वातवो द्विविधं पुनः ।

यथास्वनग्निभिः पाकं यान्ति किट्टप्रसादवत् ॥ Caraka : Cikitsā 15 : 15.

2. यथास्वेनोष्मणा पाकं शरीरा यान्ति वातवः ।

क्षीतसा च यथास्वेन वातुः पुष्पति वातुतः ॥ Caraka : Cikitsā 8 : 39.

SCHEME SHOWING DIFFERENT STEPS ĀHARADRAVYAS UNDERGO TO BE TRANSFORMED INTO DHĀTU ĀHĀRA + JĀTHARĀGNI

(82)

Diferent Aśās of Āhāra

Bhūtāgni, in which agni present in each group having been ignited by jāthar-āgni transforms the vijātya annarasa into organism specific or sajātya poṣaka dravyas of dhātus.

These upādāna dravyas combine in different proportions for the formation of dhātus.

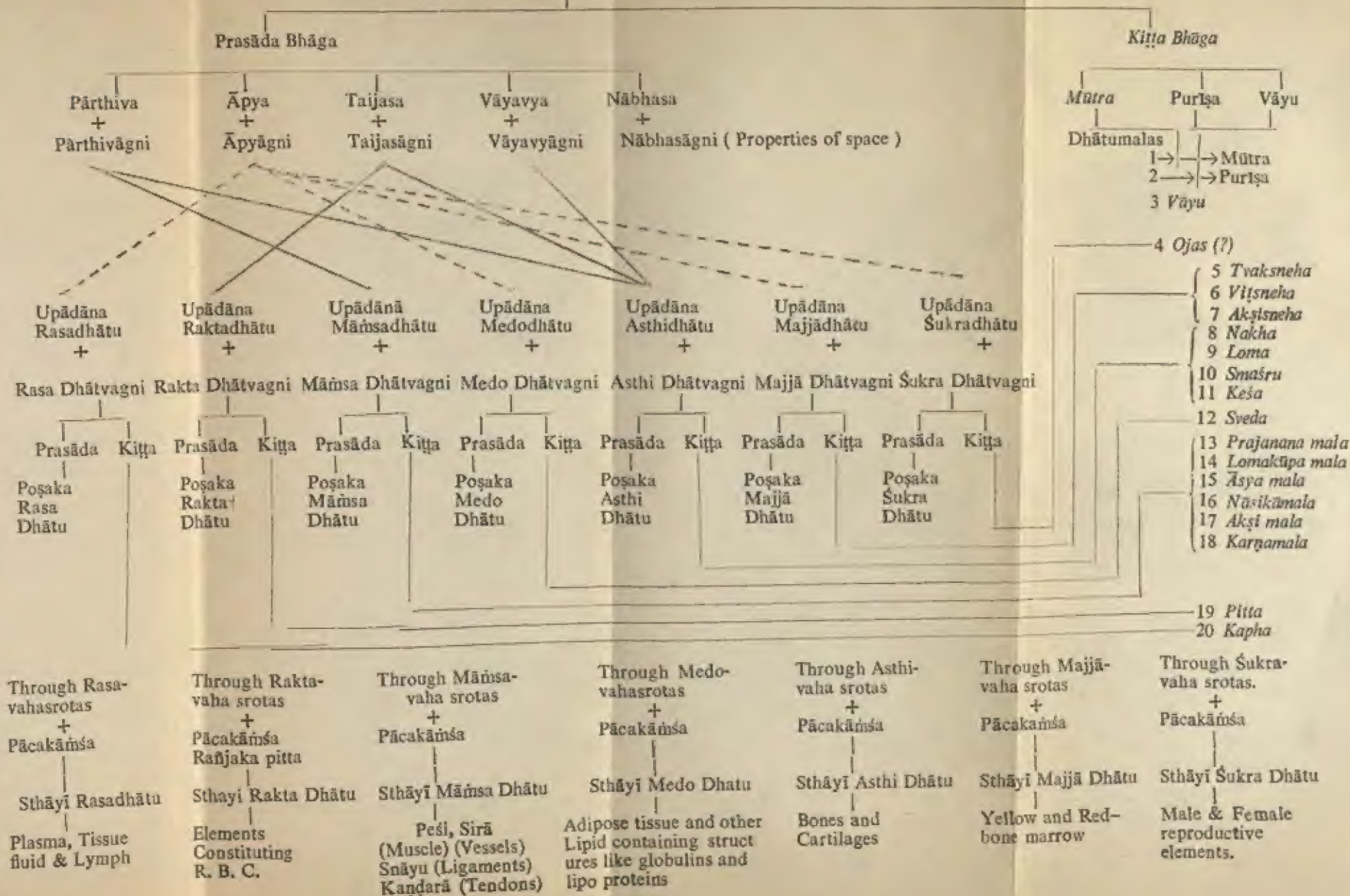
Action of Dhātvaṅis.

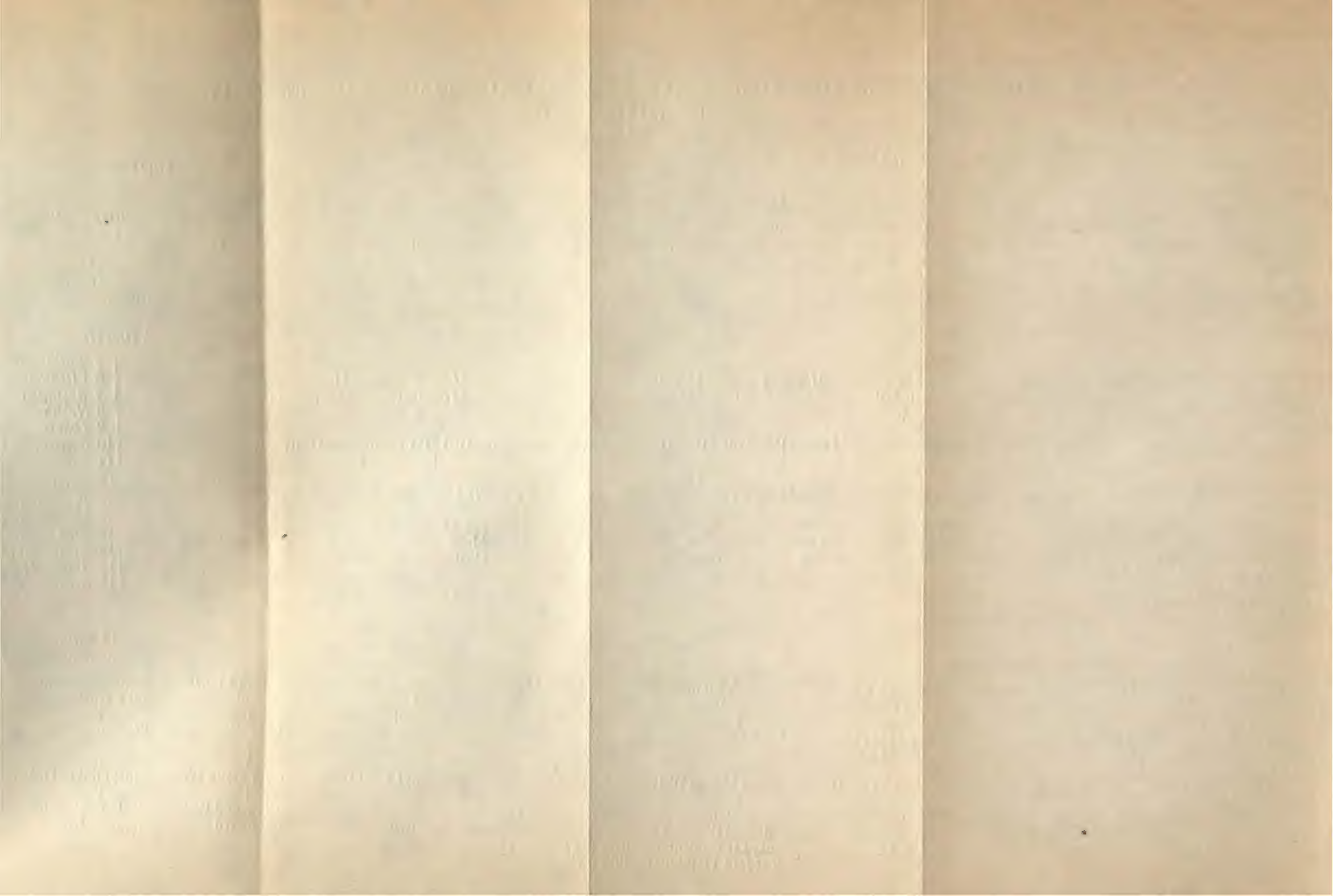
Result of Dhātvaṅi Pāka :

Prasādhāga as Poṣya or asthāyī dhātu and Kṛtādhāga some portion of which are used up by the body and others eliminated either alone or in combination with anna kṛtā.

Poṣakadhātu carried by specific srotāmsi.

Before they are changed to poṣyadhātu, they again, undergo pāka by specific pācakāmsas. After pāka, they are changed to sthāyī or poṣya dhātu. Poṣyadhātu, entering in to the constituent of the body structures.





nutrients, obtained from food sources are the food for *śarīra dhātus* and they contribute to the normalcy of the latter.¹

Similar references to *dhātvagnipāka* and the order, in which, it occurs are available in *samhitā granthas* and a few more of them, obtained from *Aṣṭāṅgasamgraha* is furnished in the footnote below.² The facts that emerge out of these references are—

- (1) The *āhāradravyas*, already suitably dealt with by *jātharāgni* and *bhūtāgni pākas*, are taken up for *dhātvagni pāka*.
- (2) *Dhātvagni pāka* has two aspects viz., (a) *Kiṭṭa pāka*; (b) *Prasāda pāka*.³
- (3) The final products arising out of *prasāda pāka* are then transformed to the *śarīra-dhātus* through their respective *srotāṁsi*.⁴

The seven kinds of *dhātvagnis* obviously refer to substances which like enzymes catalyse the synthesis of seven kinds of nutrient substances, required for the use of the seven species of *dhātus*—each *agni*, aiding the conversion of nutrient substances into what may permissibly be called “precursor substances” of the formed *dhātus*, already present in the body. This view is based upon references to *poṣaka* or *asthāyi dhātus* and *poṣya* or *sthāyi dhātus*, found mentioned in Cakrapāṇi's commentary on *Carakasamhitā*.⁵ Thus, the *rasāgni* would

1. विविधमशितं पोतं लीढं स्वादितं जन्तोर्हितम् अन्तराग्निसंयुक्षितबलेन यथास्वेनोष्मणा सम्यग्निपच्यमानं कालवत् अनवस्थितसर्वधातुपाकमनुपहतसर्वधातुममारुतस्रोतः केवलं शरीरं बलवर्णसुसायुषा योजयति, शरीरधातुनूययति च । धातवो हि धात्वाहाराः प्रकृतिमनुवर्तन्ते । *Caraka : Sūtra* 28 : 3.
2. ताभ्यां च सारमलाभ्यां तदात्मकानामेव शरीरपुणानां धात्वाख्यानां यथास्वं स्रोतांसि पारम्पर्येण व्यवच्छिन्ना सन्तानमापूर्यन्ते । स्रोतोभ्यश्च यथाविभागं यथावयवमेव धातवः पुष्यन्ति । *Aṣṭāṅgasamgraha : Śarīra* 6 : 61-62.
3. प्रसादकिट्टी धातूनां पाकादेव दिवाच्छेतः । *Aṣṭāṅgahṛdaya : Śarīra* : 3 : 64.
4. यथास्वेनोष्मणा पाकं शरीरा यान्ति धातवः । स्रोतसा च यथा स्वेन धातुः पुष्यति धातुतः ॥ *Caraka : Cikitsā* 8 : 39.
5. यतो द्विविधो रसः—स्थायी पोषकश्चेति, तत्र धातुपोषकपोष्यरसांशयोर्भेद-विवक्षया भेद उक्तः, इह स्थायिपोषकरसांशव्येकतया निर्दिष्टौ, स्थायिरस-पोषकरसमागयोः स्थानभेदाद्यभावादिकत्वम् ; एवं कृत्वा सप्तधातुकं शरीरमुच्यते ।

Cakrapāṇi on *Caraka Cikitsā* 15 : 16.

catalyse the conversion of appropriate substances and their incorporation into the *rasādi dhātus* which latter serves as the vehicle of transport of the remaining *poṣaka* or *asthāyi dhātus*. Similarly, catalysed materials obtained from *āhāra-rasa* are made available to corresponding *sthāyi* or *poṣya dhātus*.

It is obvious that the term *dhātvaṅni* is a collective noun standing both for group specific and reaction specific enzymes. Even so, metabolic reactions envisaged above are not exclusively anabolic but this also comprise catabolic reactions, which yield waste products or *kiṭṭa* in the process. This view is implicit in the *kiṭṭapāka* referred to by Cakrapāṇi Datta.¹ The outcome of *kiṭṭa pāka*, are discharged from the body at periodical intervals and the remaining parts are utilised for the production of a number of structures of the body, such as hair, nail etc.

Prasāda Pāka—The available description of this *pāka* in *samhita granthas*, is reminiscent of synthetic reactions, which form part of the intermediary metabolism—the latter term being described as “all changes which may take place between the moment of entry and the moment of discharge of ultimate chemical products into the environment”;² or in the alternative specific chemical reactions which occur within the organism—the other aspect being what is known as energy metabolism which deals with the overall energy production. In general, the process of new tissue formation and the maintenance of the structures already formed constitute tissue building or synthesis. In general, it represents the union of smaller into larger molecules. The reverse process of tissue break down is obviously, concerned primarily with the splitting of the larger protoplasm into smaller ones. The two aspects, the anabolic and catabolic, respectively constitute

1. भूतान्निव्यापारं दर्शयित्वा धात्वन्निव्यापारं दर्शयन्नाह सप्तभिरित्यादि । देह-
धातारः इति विशेषेण देहधारकाः । द्विविधमिति द्विप्रकारं पाकम् । तदेव
पाकद्वयमाह—किट्टप्रसाद इति ; किट्टप्रसादरूपमित्यर्थः ।

Cakrapāṇi on *Caraka* : *Cikitsā* 15 : 15.

2. Gould : Medical Dictionary.

metabolism as a whole. As stated above, *prasāda pāka*, obviously relates to anabolic aspect and the *kiṭṭa pāka*—the catabolic.

Thus, *dhāradravyas*, subjected to *dhātuvagni pāka* synthesise from out of the nutrient substances, constituents required for the synthesis of each *sthāyi* (*poṣya*) or formed *dhātu*—the former known as *asthāyi* (*poṣaka*) or precursor *dhātu*. The *dhātuvagnipāka* may also be described from the point of view of biochemical reactions as follows : regardless of the nature of the nutrient material, present in the *annarasa*—this may represent *dravyas*, possessing *ṣaḍrasas*—the *pārthivāṁśa* of *annarasa* being taken up for the synthesis of the *pārthiva bhāvas* of the compound necessary for *sthāyi dhātus*; *āpyabhāvas* likewise, and so on as regards *āgneya*, *vāyavya* and *nābhasa*. Be this, as it may, the important point that needs mention here is the fact that the products of *bhūtāgnipāka*, which represent the ingredients, required by the several *dhātus* in the body, are catalysed by *rasāgni*, *raktāgni*, *māmsāgni*, *medogñi*, *asthyagni*, *majjāgni* and *śukrāgni*, the resulting products in the *prasāda pāka*, being the *asthāyi rasadhātu*, *raktadhātu*, *māmsadhātu*, *medodhātu*, *asthidhātu*, *majjadhātu* and *śukradhātu*. These end-products or precursor *dhātus* are, then, stated to be transported through *rasadhātu* to the *sthāyi dhātus*, through *srotāṁsi*, specific to each *dhātu* where in the presence of *pācakāṁśas*, these *asthāyi dhātus* are synthesised as part of the existing *sthāyi dhātu*.

Kiṭṭa Pāka—The outcome of *dhātuvagni vyāpāra* is stated to yield, among others, the following waste products—

sveda (sweat), *mūtra* (urine), *purīṣa* (faeces), *vāta* (gases like CO₂, indol, skatol, ammonia, hydrogen-sulphide etc.), *pitta* (bile pigment), *śleṣman* (mucoid excretions), *karṇa mala* (waxy excretions from the ear), *akṣimāla* (mucoid excretions from the eye), *Nāsikāmāla* (nasal discharge), *āsyamāla* (lactic and ascorbic acids, choline, phenols, urea, glucose, thyrocynate, iodides, nitrates, calcium etc.¹), *loma-kūpamāla* (excretions discharged through hair follicles—

1. West and Todd : A Text Book of Biochemistry, 2nd Edn. p. 462.

sebum), *prajanaṇa mala* (smegma and vaginal discharges), *keśa* (hairs), *śmaśru* (beard), *loma* (hairs all over the body, other than the above) and *nakha* (gelatinous and fibrous tissue, keratin of the nails etc.).¹

It would appear from the above that waste products arising out of *kṣīṇapāka*, are the precursor elements with which several excretions referred to above are composed. As examples may be cited the cases of *pūriṣa*, *mūtra* and *nakha*.

Pūriṣa, is seen to represent, not only the undigested food—residue of the intestine, but also, *malas*, which arise from the *kṣīṇapāka* of *dhātus* and which are excreted into the *pakvāśaya* through the *pūriṣadharā kalā*.² These two, together with other substances, present in the *pakvāśaya*, like *sahaja kṛmīs*, which inhabit that locality, are thrown out as *śakṛt* or faeces.³

It has been shown by modern researches that, "The faeces are composed of food residues, bacteria, materials secreted through the wall of the intestine and bile, leucocytes and disquamated epithelial cells. Food residues constitute a much smaller portion of the bulk of faeces than is usually realised. The fat, protein and carbohydrate of the diet are practically absorbed and if the food be free from indigestible material, especially, cellulose, the faeces are composed almost entirely

1. किङ्गात् स्वेदमूत्रपुरीषवातपित्तदलेष्माणः कर्णाक्षिनासिकास्वलोकूपप्रजननमलाः केशदन्तुलोमनखादयश्चावयवाः पुष्पानि । *Caraka : Sūtra* 28 : 4.

2. यक्षुक्षमन्तात् कोष्ठं तयान्वाणि समाधिता ।

उष्णुक्स्थं विमज्जे मलं मलधरा कला ॥ *Sūruta : Śāstra* 4 : 16.

3. The water content of the faeces is usually from 60 to 70 per cent by weight. The 20 to 30 per cent dry matter is composed primarily of undigested dietary constituents, such as cellulose material, hair and seeds, fatty material, mineral matter and bacteria. The undigested food protein, carbohydrate and fat amount to very little since the digestion and absorption of these substances is normally 95% to 98% complete. Practically all the nitrogen present is of bacterial origin.

(West and Todd : Text Book of Biochemistry, 1955 edition, page 500).

of bacteria and secretions. During starvation, for example, faeces continue to be formed and their composition does not differ materially from that of faeces, passed after an ample diet. Also, a segment of bowel when isolated from the rest of the intestinal tract, becomes, after a time, packed with a mass of pasty faecal material..... . Faecal fat is largely endogenous, continuing to appear in the faeces, though all fatty materials have been excluded from the diet; it differs chemically from ordinary food fat, but resembles closely the blood lipids; part of the cholesterol and lecithin is of biliary origin. Calcium, phosphates, magnesium and other inorganic materials in the faeces, are also derived mainly from the blood." ¹

The foregoing confirm, in part, the Āyurvedic view that some of the products of *kṛtāpāka* of the *dhātvagni vyāpāra*, are excreted through the *purīṣa-dharā kala*, ² into *pakvāsaya*, where together with *annakṛtā* and *malarāñjaka pitta*, the entire matter now known as *śakṛt*, is eliminated from the body.³

The foregoing can be represented as here under :

- (1) *Āhāra + jāṣṭhāgni sūra + kṛtā* (*purīṣa* etc.)
- (2) *Sāra + Dhātvagni prasāda + kṛtā* (*purīṣa* etc.)
- (3) *purīṣāmśa* of *dhātu kṛtā* + *purīṣāmśa* of *annakṛtā* = *Śakṛt*.

As regards *mūtra*, it is seen from modern researches that indol and skatol contribute to the characteristic odour of the faeces. According to Abraham White *et al*, "indol-acetic-acid, which is excreted in normal urine, could be a result of its

1. Best and Taylor : *Physiological basis of Medical Practice* : 1935 Edn. page 589-90.
2. *Kalā* have been described as structures that define and separate the different basic structural entities—*dhātus*—corresponding to the epithelial lining of various cavities. *Purīṣadhara kala* extends from *yakṛt*, intestine and other abdominal viscera and serves as a barrier between the faecal matter and chyle. It may, also, be understood as the lining of the large intestine that secretes faeces into this place from the blood.
3. The formation of *annakṛtā* (*purīṣāmśa*) separated from *sārabhāga* of *anna*, under the influence of *jāṣṭhāgnipāka* has been described in pages 76-77.

formation in and subsequent absorption from large intestine. Indol-acetic-acid is also present in foods of plant origin and this may become another reason of its occurrence in the urine. The second example is tyrosin which in reactions of the large intestine, yields phenol. Reactions of this type probably account for the small amount of phenyl sulphate which may be found in the urine and for the presence of indican (indoxyl-sulphate) as a normal constituent of the urine since these aromatic alcohols are formed in the large intestine from tyrosin and tryptophen respectively absorbed from the gut conjugated with the sulphate in the liver and excreted in the urine." ¹

The foregoing relate to the intestinal contribution to some of the ingredients to *mūtra*. The remaining ingredients of it such as ammonia, urea, creatinine, uric acid etc., are seen to be derived from the blood and represent the outcome of the metabolic processes.

What has been stated above are seen to support the *Āyurvedic* view that *dhātuvagnipāka* contributes in part substances which are utilised for the composition of *mūtra*. In essence, the nature of *puriṣa* as well as *mūtra* may be taken as an index of *jāṭharāgni* and *dhātuvagnipākas*.

Some of the products of *kiṭṭa pāka* of *dhātuvagni vyāpāra* corresponding obviously to degradation products specially of proteins are seen to be utilised for the synthesis of *keśa* (hairs), *śmaśru* (beard), *loma* (hairs of the body other than the above two), and *nakha* (nail) etc. This is reminiscent of the modern view that some of the body proteins are degraded and built up as collagen fibres, keratins, hairs and nails etc.

The *prasāda* and *kiṭṭa pāka*, described above can be illustrated with the example of the formation of *rasa* and *rakta dhātus* corresponding to plasma and erythrocytes.

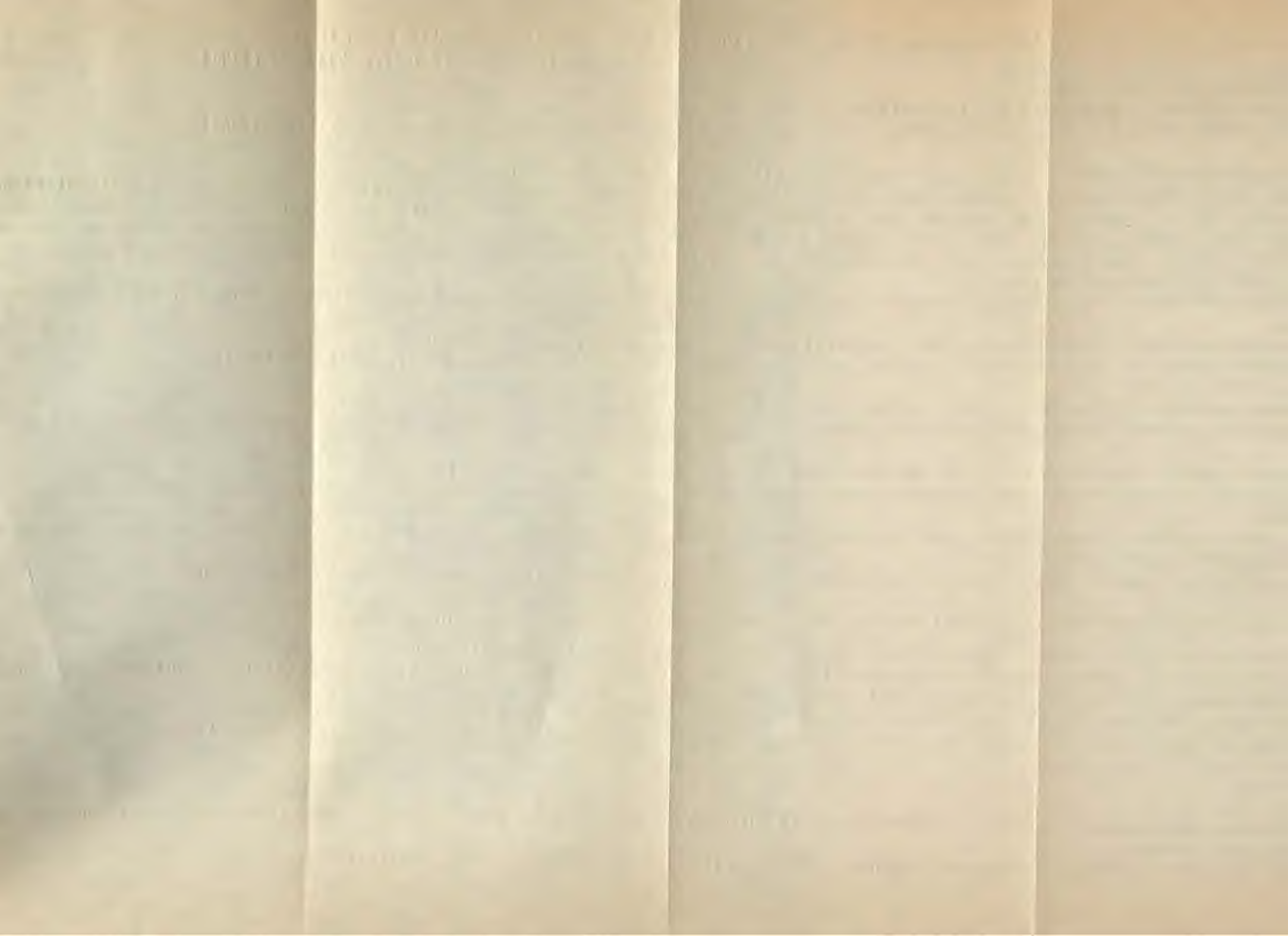
Rasadhātu—Substances, essentially protein, in nature (*pārthiva* and *ūpya* predominantly) in the *annarasa*, corresponding to the amino acids, brought to the *yakṛt*, are synthesised

1. Abraham White *et al* : Principles of Biochemistry : 1954 edition, pages 515-16.

1. *Dravyas* required for the synthesis of the constituents.
 (A) of *rasadhātu*, present, among others, in *āhāra rasa*. + *Rasāgni* → *Asthāyī* or *poṣaka rasa dhātu* (*Prasāda*) + *Kapha*¹ (*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka rasadhātu* + *Pācakāṁśa* → *Poṣya* or *sthāyī rasadhātu* (*Plasma*)²
2. (A) *Dravyas* required for the synthesis of the constituents of *raktadhātu*, present among others in *sthāyī rasa*. + *Raktāgni* → *Asthāyī* or *poṣaka raktadhātu* (*Prasāda*) + *Pitta*³ (*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka raktadhātu* + *Pācakāṁśa*⁴ + *Rañjakāgni* → *Poṣya* or *sthāyī raktadhātu* (Elements which compose the erythrocyte)
Note:—According to the concept, as now oriented, which is in keeping with the Ayurvedic view that, it is *rasa*, which is circulating throughout the body, having its main seat in the heart or *hṛdaya*⁵—and which, in keeping with the root-meaning of the term *rasa gatau* “अहरहर्गच्छतीति रसः”⁶—‘*rasa*’ because it always moves and permeates through different parts of the body and also, the function of *rasa* has been described as the medium that transports *prasāda* to and *malas* from *dhātus*. *Yakṛt* is the place, where this *sthāyī rasadhātu* is formed, for the most part. These *dravyas*, which are present in the *āhārārāsa* or *sāra*, in this view, undergo *dhātuvāgnipāka* for the most part in the *Yakṛt* and *Poṣakadhātus* formed in the *pāka*, are added to the circulating *rasa*, which make them available to all the tissues in the body, to meet their needs.
3. (A) *Dravyas* required for the synthesis of the constituents of *māṁsadhātu*, present among others in *sthāyī rasa*. + *Māṁsāgni* → *Asthāyī* or *poṣaka māṁsadhātu* (*Prasāda*) + *Karṇa*, *akṣī nāsikā*, *ūśya*, *lomakūpa* and *prajānana mala* (*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka māṁsa dhātu* + *Pācakāṁśa* → *Poṣya* or *sthāyī māṁsadhātu* (Enters into the composition of *peśi*, *snāyu*, *Kaṇḍara sirā*, etc.)
4. (A) *Dravyas* required for the synthesis of the constituents of *medo dhātu*, present among others in *sthāyī rasa*. + *Medogñi* → *Asthāyī poṣaka medodhātu* (*Prasāda*) + *Sveda* (*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka medodhātu* + *Pācakāṁśa* → *Poṣya* or *sthāyī medodhātu* (Enters into the composition of adipose tissue)
5. (A) *Dravyas* required for the synthesis of the constituents of *asthi dhātu*, present, among others in *sthāyī rasa*. + *Asthiyagni* → *Asthāyī* or *poṣaka asthidhātu* (*Prasāda*) + *Keśa*, *śmaśru*, *loma*, *nakha* (*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka asthidhātu* + *Pācakāṁśa* → *Poṣya* or *sthāyī asthi dhātu* (Enters into the composition of bones and cartilages)
6. (A) *Dravyas* required for the synthesis of the constituents of *majjadhātu*, present, among others in *sthāyī rasa*. + *Majjāgni* → *Asthāyī* or *poṣaka majjadhātu* (*Prasāda*) + *akṣi*, *viṭ*, *tvak sneha* (*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka majjadhātu* + *Pācakāṁśa* → *Poṣya* or *sthāyī majjadhātu* (Enters into the composition of yellow and red bone marrow more particularly the latter, forming the elements of one of the *raktasthānas* in addition to *yakṛt* and *plihā*)
7. (A) *Dravyas* required for the synthesis of the constituents of *śukradhātu* present among others in *sthāyī rasa*. + *Śukrāgni* → *Asthāyī* or *poṣaka śukradhātu* (*Prasāda*) + *Ojas*⁷—?—(*Kiṭṭa*)
 (B) *Asthāyī* or *poṣaka śukradhātu* + *Pācakāṁśa* → *Poṣya* or *sthāyī śukradhātu* (Enters into the composition of the male and female (?) reproductive elements)

1. This obviously, refers to intermediary metabolites of protein metabolism which are utilised for the Production of mucus and such other secretions and excretions.
2. Tissue fluid, which is also a part of the concept of *rasadhātu* is derived from plasma and lymph is derived from the tissue fluid, which again, combines with plasma, towards the end of its return journey. Slight variations in composition between plasma on the one hand, tissue fluid and lymph on the other are naturally to be expected.
3. These, obviously, represent waste-products, which arise during the synthesis of the essential constituents of erythrocytes, such as—its pigments, etc.
4. According to this concept, various ingredients, with which the erythrocytes or the elements responsible for conferring red colour to blood, are synthesised by *pācakāṁśa* and *raktāgni* contributed by *hṛdaya* and *yakṛt*, yield the finished product—the erythrocyte.
5. *Caraka* : *Sūtra* 30 : 8.
6. *Suśruta* : *Sūtra* 14 : 13.
7. According to *Aṣṭāṅghṛdaya*, *ojas* is stated to be the *kiṭṭa* of *śukra*, and according to others it is held to be an *upadhātu* or formed substance which does not undergo any chemical transformation. There are still others who treat *ojas* as the eighth *dhātu*. References :—

A. *Aṣṭāṅghṛdaya* : *Sūtra* 3 : 63 : B. *Śūrīyādhara* : *Pūrvakhaṇḍa* 5 : 16 C. *Cakrapāṇi* on *Caraka* : *Sūtra* 3 : 7 D. *Kāyaprasaṁhita* : *Sūtra* 28 E. *Suśruta* : *Sūtra* 15 : 19.



in this organ into characteristic structural constituents of the *sthāyi rasadhātu*; corresponding to plasma proteins,¹ and plasma respectively. These ingredients, plus water obviously replace those which have been already utilised. Thus, the main circulating fluid—*rasa*, serves as the transport medium of nutrients or *poṣakadravyas* (free amino acids, glucose, lipids, minerals, hormones etc.) required for the synthesis of all other *dhātus* in the body and the breakdown products of enzymes or those, which occur during the synthesis of enzymes. These substances must naturally fluctuate more or less widely in concentration depending upon bodily activities and the wear and tear sustained by the *śārīra dhātus*. These are nutritions in transit. Even-so, *rasadhātu* serves as the medium of transport of *malas* or waste products from the *śārīradhātus* and *avyavayas* for being disposed of. Our immediate concern is with the constants of the *rasadhātu* itself.

Rakta dhātu—*Rasadhātu*, having been formed and replenished, carries in it, ingredients required for the synthesis of the several constituents of the *sthāyi rakta dhātu*, which constantly undergo destruction. Steps involved in the formation of *sthāyi raktadhātu*, can be visualised hereunder :

Firstly, the *poṣaka dravyas*, derived from *āhārarasa* are catalysed by *rasāgni* to form the *asthāyi* or *poṣaka rasadhātu* i.e. formed elements, which are meant to be utilised for the synthesis of the *sthāyi raktadhātu*. These basic materials, together with *rañjakāgni* or *rañjaka pitta*, as it is also known, are finally built up as the fully formed *raktadhātu* with *pācākāṁśa*, catalysing the reaction. This can be written as follows—

- (1) *Raktapoṣakadravyas* in *rasadhātu* : *raktāgni poṣaka* or
asthāyi raktadhātu.
- (2) *Asthāyi rakta dhātu* + *rañjakāgni* *sthāyi raktadhātu*.
Pācākāṁśa

The orientation of the mode of formation of *raktadhātu* offered above on the basis of textual material available in *sāhitya granthas* and some of the important commentaries

1. Albumen, globulin and fibrinogen.

thereon are supported as it were by modern researches on the formation and maturation of erythrocytes.

Beaumont in his wellknown book on medicine observes that, "the primitive marrow cell is converted into a megabloblast, possibly with the aid of an *unknown agent* (italics mine). The active principle from the liver and stomach and, *perhaps*, the vitamin B complex helps in the change from megaloblast to normoblast. Iron, copper, thyroxin and possibly vitamin C are concerned with the change from normoblast to erythrocyte."¹

It will be seen from the above that the maturation of erythrocyte from the stage of megaloblast to normoblast needs substances noted in the foregoing paragraph. These are in the nature of *poṣaka dhātus*—essentially *āgneya* in nature. In addition, the active principle from liver and stomach, corresponding to the *rañjakapitta* of Suśruta and Vāgbhaṭa is also seen to be necessary at distinctly different stages of the evolution of the erythrocyte.

Substances referred to in the foregoing paragraph apart, the process of maturation of erythrocyte is also seen to need the aid of an 'unknown agent', mentioned by Beaumont. By implication, this process may not be completed with iron, copper, thyroxin, vitamin C, the stomach and liver factors only and it needs in addition, a factor, the identity of which is not yet known. The author has to suggest, as a hypothesis, that proceeding on the basis of study of the part played by *pācakāṁśas*, in the final stages of the formation of *sthāyī raktadhātu*, the 'unknown agent' referred to by Beaumont, may possibly be some of the cathepsins the analogues of *pācakāṁśas*, present in *saraka medas* (red-bone-marrow).²

1. Beaumont : Medicine, 5th Edn. 496 page.

2. *Āyurveda* has recognized *majjā*, present in the hollow of long bones, as one of the *dhātus* (मेदसस्तानि पूर्वन्ते स्नेहो मज्जा ततः स्मृतः । Caraka : Cikitsā 15 : 32). *Vaidyaka Śābdasindhu* has described *majjā* as *buddha sneha* or pure fat (मज्जा अस्थनः शुद्धस्नेहभागे..... स्नेहोऽस्थनः शुचिरेव स्यात्). This *majjā* of *Āyurveda* has not been described as one of the *raktasthānas*. On the other hand

Metabolic equilibrium

That the two aspects of *dhātvaṅnipākas* viz., *prasāda* and *kṛtā*, under normal states of health, maintain an equilibrium is seen from *Aṣṭāṅgasamgraha*¹ and Cakrapāṇi's commentary on Caraka. Says Cakrapāṇi, "*Rasādi dhātus*," which are always destroyed are being replaced by *dhātvāhāras*, derived from the four kinds of nutritions, ingested. In his view, the *rasādi dhātus* are lost in catabolic processes and such losses are made good, again, by anabolic events.² Says Cakrapāṇi, "*Sārira dhātus*, which are destroyed by their own *agnis* are replenished by four kinds of foods ingested."³

Different State of Jāṭharāgni

All the available editions of the main *Saṁhītā granthas* have described four states of *jāṭharāgni* viz., *sama*, *viṣama*,

Suśruta has designated the *majjā* or marrow present in bones other than long bones as *saraktamedas* (स्पृक्षस्थितु विश्लेषेण मज्जा त्वम्यन्तरस्थिता । अयेतरेषु सर्वेषु सरक्तमेद इष्यते । *Suśruta* : *Sārira* 4 : 16).

Elsewhere, discussing the *sthānas* of *rañjakapitta* he has mentioned that this *pitta*, located in its own *sthāna*, supports the *raktasthānas*, except *yakṛt* or liver and *pīthā* or spleen, (*Suśruta* : *Sūtra* 21 : 16), which are the *sthānas* of *rakta* as well as *rañjakapitta*. It has been suggested that the inclusion of *saraktamedas* as one of the *raktadhātus*, would help in enlarging the theories of the formation of blood from the point of view of *Āyurveda*. In the present context *pṛvakāṁśa* in *saraktamedas*, is considered to be necessary for the final transformation of the *asthāyi raktadhātu* into *sthāyi raktadhātu*. The former would include all materials produced and processed by *bhūtagṇi* and *dhātvaṅni pākas*, as may be required, for the synthesis of the *sthāyi raktadhātu*.

1. उत्तरोत्तरानुप्रवेशेऽपि पूर्वेषां स्रोतसां यथाकालं सम्यक् आहारोपयोगेन परिणामवताप्यायमानानां नापचयो भवति । ततश्च धातुवायुधाः प्रसादमलाः स्वं स्वमेव मानमनुवर्तन्ते यथावयःशरीरम् । *Aṣṭāṅgasamgraha* : *Sārira* 6 : 63.
2. धातवो रसादयः, नित्यं क्षीयमाणाः अक्षितादिजनिताः चात्वाहारा एव सन्तः परं स्वास्थ्यमनुवर्तन्ते नान्यथेत्यर्थः । Cakrapāṇi on Caraka : *Sūtra* 28 : 3.
3. तेन सर्वदा स्वान्निपाकक्षीयमाणधातोः शरीरस्थादिना उपचयादियोजनमुपपन्नमिति दर्शयति । Cakrapāṇi on Caraka : *Sūtra* 28 : 3.

tikṣṇa and *manda*.¹ This classification of *agni* is seen to have two aspects viz., (a) an aspect, which may be described as natural and which forms part of *prakṛti* or temperament of the individual,² and (b) an aspect, in which three *doṣas* become involved, due to the operation of different etiological factors (*ādhyātmika*, *ādhibhautika* and *ādhidāivika*) on the body, leading to a reciprocal influence, between them and *agni*.³

(a) *Natural states of agni, as a part of temperamental make-up—*

Prakṛti or temperament is inherited and predetermined; that is to say, genetically determined. According to *Āyurveda*, unless described otherwise, *prakṛti* is determined by the state of *tridoṣas* in the parents at the time of fecundation.⁴ In this view, the state of *tridoṣas* in the parents at the time of their mating influences the *śukra* or male-reproductive element and *artava* or female reproductive element. Accordingly, the *prakṛti* of the child to be born is stated to be influenced and determined.⁵

1. (a) अग्निषु शरीरेषु चतुर्विधो विशेषो बलभेदेन भवति तस्या—तीक्ष्णो, मन्दः, समो, विषमश्चेति । *Caraka : Vimāna* 6 : 12.

- (b) प्रागभिहितोऽग्निस्त्वस्य पाचकः । स चतुर्विधो भवति, दोषानभिपन्न एको, विक्रियामापन्नस्त्रिविधो भवति । *Suśruta : Sūtra* 35 : 20.

- (c) समोऽग्निविषमस्तीक्ष्णो मन्दश्चेति चतुर्विधः ।

Aṣṭāṅgahṛdaya : Sūtra 3 : 74.

2. एते चतुर्विधा भवन्त्यग्नयः—चतुर्विधानामेव पुरुषाणाम् । तत्र समवातपित्तश्लेष्मणां प्रकृतिस्थानां समा भवन्त्यग्नयः । वातलानां तु वाताभिभूतेऽग्न्यधिष्ठाने विषमा भवन्त्यग्नयः । पित्तलानां तु पित्ताभिभूते ह्यग्न्यधिष्ठाने तीक्ष्णा भवन्त्यग्नयः । श्लेष्मलानां तु श्लेष्माभिभूतेऽग्न्यधिष्ठाने मन्दा भवन्त्यग्नयः ।

Caraka : Vimāna 6 : 12.

3. विषमो वातेन, तीक्ष्णः पित्तेन, मन्दः श्लेष्मणा, चतुर्थः समः सर्वसाम्यादिति ।

Suśruta : Sūtra 35 : 20.

4. (a) शुक्रशोणितसंयोगे यो भवेद् दोष उत्कटः ।

प्रकृतिर्जायते तेन तस्या मे लक्षणं स्यात् ॥ *Suśruta : Sūtra* 4 : 58.

- (b) शुक्रार्तवस्वैर्जन्मादौ विप्रेणैव विपक्षिमेः ।

तैश्च तिस्रः प्रकृतयो ह्येनमप्युत्तमाः पृथक् ॥ *Aṣṭāṅgahṛdaya : Sūtra* 1 : 9.

5. Caraka has furnished details as regards factors, which determine or influence, *doṣa* states in the parents, from the point of view of—

The states of *agni*, according to *prakṛti* are as follows—

<i>Prakṛti</i> or temperament	States of <i>agni</i> ¹	Confer predis- position to ²
<i>Vāta prakṛti</i>	<i>Viśamāgni</i> (erratic or fitful)	<i>vāta vikāras</i>
<i>Pitta prakṛti</i>	<i>Tikṣṇāgni</i> (acute & sharp)	<i>pitta vikāras</i>
<i>Kapha prakṛti</i>	<i>Mandāgni</i> (Dull & Slow)	<i>kapha vikāras</i>
<i>Sama prakṛti</i>	<i>Samāgni</i> (normal)	resistance to disease.

This classification is of importance in preventive medicine.

(b) According to Vāgbhaṭa, the functioning of *agni* is normal, when *samāna vāyu* is functioning normally, in its own *sthāna*. On the other hand, if this *vāyu* moves to places other than its own, *agni* too will be disturbed; if the same *vāyu* commingles with *pitta* then the *jāṭharāgni* becomes *tikṣṇa* or acute; on the other hand, if it is afflicted by *kapha*, then the *agni* becomes *manda* or dull. ³ In other words, if neural

- (a) *Kāla*—relates to seasonal variations or fluctuations in *dōṣa* rhythm.
- (b) *Garbhāśaya*—The states of *dōṣas*, which have a bearing on *garbhāśaya*, possibly the *sthānika vāyu*—*apāna*, the *sthānika kapha* of *trika*—*avalambaka* and *sthānika pitta*—(?).
- (c) The influence of nutrition and activities—physical and mental—of the mother which may influence the activities of the one or other of the *dōṣas*.
- (d) *mahābhūta vikāra prakṛti*—physico chemical peculiarities of the *śukra* and *śoṣita* (*Caraka : Vimāna* 8 : 95).

In addition to the above, which have been brought under *pratyātmaniyata* type of *prakṛti* (vide *Caraka : Indriya* 1 : 5) other factors such as *jāti* (race), *kula* (family), *deśa* (geographical influences), *kāla* (season) and *vayaḥ* (age) etc. play an important role, in the formation of *prakṛti*.

1. तैर्भवेद्विषमस्तीक्ष्णो मन्दश्चाग्निः समैः समः ॥ *Agñāṅgahṛdaya : Sūtra* 1 : 8.
2. (a) विषमो वातजान् रोगान् तीक्ष्णः पित्तनिमित्तजान् ।
करोत्यक्षिप्तदा मन्दो विकारान् कफसम्भवान् ॥
Sūtrata : Sūtra 35 : 22.

(b) *Mādhanandāna* 6 : 2.

3. समः समाने स्थानस्थे विषमोऽग्निविभागैः ।

पित्तामिर्मूर्च्छते तीक्ष्णो मन्दोऽस्मिन्कफपोहिते ॥

Agñāṅgahṛdaya : Śāstra 3 : 73.

influences on the secretory mechanism of gastro-intestinal glands are normal, then the gastro-intestinal digestive events are also normal or *sama*. On the other hand, if neural influences on the secretory activities of gastro-intestinal glands are hyper-active, then the condition is referred to as *atyagni* or *tikṣṇāgni*. If, on the other hand, there is hypo-secretion of the gastro-intestinal glands due to lack of adequate neural stimuli then the resulting condition is *mandāgni*. Lastly, irregular and erratic secretions—sometimes more and sometimes less—correspond to *viṣamāgni*. The symptomatology of the four states of *agni* are furnished in the table below :

Name of the <i>doṣa</i>	State of the <i>agni</i>	Symptoms
<i>Vāta</i>	<i>Viṣamāgni</i>	Sometimes digests slowly, sometimes normally and sometimes produces <i>ādhmāna</i> (distension of abdomen), <i>śūla</i> (colicky pain), <i>udāvarta atisāra</i> (diarrhoea), <i>jaṭhara</i> (ascitis), <i>gaurava</i> (heaviness), <i>antrakūjana</i> (gurgling sound in the intestine), <i>pravāhapa</i> (dysentery).
<i>Pitta</i>	<i>Tikṣṇāgni</i>	Digests even large quantities of all, too frequent meals; after digestion produces <i>galasṛṣa</i> and <i>dāha</i> (parched throat) <i>oṣṭha śṛṣa</i> and <i>dāha</i> (parched lip) <i>tālusṛṣa</i> and <i>dāha</i> (parched palate) and <i>santāpa</i> (heat and burning sensation).
<i>Kapha</i>	<i>Mandāgni</i>	Cannot digest, even normal diet properly causing <i>udaragaurava</i> (heaviness of abdomen), <i>śirogaurava</i> (heaviness of the head) <i>kāsa</i> (cough), <i>śvāsa</i> (dyspnoea) <i>praseka</i> (salivation), <i>chardi</i> (emesis), <i>gātrasadana</i> (weakness of the body).
<i>Samadoṣa</i>	<i>Samāgni</i>	Properly digests the normal diet.

This is a state in which the action of *jāṭharāgni* is considerably inhibited due to the dominant influence of *kapha*, of the three *dōṣas*. Hence, this state of *agni* *Mandāgni* is known as *mandāgni*. In this state, the *agni* is unable to digest (and metabolise) even a small quantity of otherwise easily digestible food.¹

The action of *jāṭharāgni* in this state is influenced predominantly by *pitta* of the three *dōṣas*. The *agni* in this condition is said to be excessively excited *Tikṣṇāgni* and hence it is known as *tikṣṇāgni*. *Tikṣṇāgni* easily digests even a very heavy meal, in a very short space of time. It causes voracious hunger—a condition usually spoken of as *atyagni*—(or *bhasmaka* by certain authorities). It makes possible for a glutton to digest his all too frequent meals. It is stated to produce parched throat, palate and lips, heat or other discomforts.²

An erratic state of *agni* arises, as a result of the influence of *vāta*, in the condition described as *viṣamāgni*. In this state, the action of *agni* is irregular and fitful. *Viṣamāgni* It sometimes helps the process of complete digestion and at other times produces distension of the abdomen, colicky pain, constipation of the bowel, dysentery, ascitis, heaviness of the limbs and loose motions.³

1. (a) दुर्बलो विदहत्यन्नं तण्डुलपूध्वमथोऽपि वा । *Caraka : Cikitsā 15 : 51.*
 (b) यस्तु स्वल्पमप्युपयुक्तमुदरशिरोगौरवकासश्वासप्रसेकश्चदिगात्रसदनानि कृत्वा महता कालेन पचति स मन्दः । *Suśruta : Sūtra 35 : 21.*
 (c) मन्दस्तु सम्यगप्यन्नमुपयुक्तं चिराल्यचेत् ।
 कृत्वास्य शोषादोषान्प्रकुञ्जनाध्मानगौरवम् ॥ *Aṣṭāṅgahṛdaya : Sūtra 3 : 76.*
2. (a) तीक्ष्णो मन्देन्धनो पातुन् विशोषयति पाकः । *Caraka Cikitsā 15 : 50.*
 (b) यः प्रभूतमप्युपयुक्तमाशु पचति स तीक्ष्णः । स एवामिप्रवर्धमानो कल्प-
 म्निरित्वाभाष्यतेः स मुहर्षुः प्रभूतमाप्युपयुक्तमभ्रमाशुतरं पचति; पाकान्ते च
 गलतास्त्वोष्ठशोषदाहसन्तापान् जनयति । *Suśruta : Sūtra 35 : 21.*
 (c) तीक्ष्णो बहिः पचेत् शीघ्रमसम्यगग्निभोजनम् ।
Aṣṭāṅgahṛdaya : Sūtra 3 : 75.
3. (a) विषमो पातुवैषम्यं करोति विषमं पचन् । *Caraka : Cikitsā 15 : 50.*
 (b) यः कदाचित् सम्यक् पचति कदाचिदाध्मानशूलोदावर्त्ततिसारजठर-
 गौरवान्प्रकुञ्जप्रवाहणानि कृत्वा स विषमः । *Suśruta : Sūtra 35 : 21.*
 (c) विषमोऽसम्यगप्याशु सम्यग्वाऽपि चिराल्यचेत् ।
Aṣṭāṅgahṛdaya : Sūtra 3 : 75.

In the well equilibrated state of functioning of *tridoṣas*, the *jāṭharāgni* is, also stated to function normally. This state of its function has been described as *Samāgni samāgni*. In other words, *jāṭharāgni* ensures complete digestion of food ingested at the proper time without any irregularities, when *tridoṣas* are in an equilibrated state of functioning.¹

Influence of different states of jāṭharāgni upon dhātus.

Since a co-relation between *jāṭharāgni* and *dhātus* has been shown to exist in the form of *pācakāmśas* present in the latter and any departure in the normal state of functioning of the former can logically be expected to influence the latter in many ways. In other words, hypo, hyper and erratic functioning of *jāṭharāgni* may be followed by hypo, hyper and erratic functioning of *pācakāmśas*, present in the *dhātus* leading to—

- (a) hypo-metabolism or *mandāgni* leading to states analogous to myxedema, resulting in *dhātuvṛddhi*.
- (b) hyper-metabolism or *tikṣṇāgni*, resulting in the digestion of *dhātus* themselves;
- (c) erratic metabolism producing metabolic vagaries.

The implication of the foregoing may be visualised as hereunder :—

Mandāgni—Due to deficient digestive secretions in the gastro-intestinal tract much of the nutrition, ingested is wasted and little if any of amino-acids, fatty acids glycerols and glucose as may be formed and absorbed may be inadequate to meet the needs of the tissues. Small quantities of these substances which may be absorbed may not be completely metabolised, due to deficient intermediary metabolism leading to the production of intermediary metabolites; hence, the synthesis of nutrition as well as energy-metabolism may be considerably lowered. In addition, the accumulation of partly

1. (a) युक्तं मुक्तवतो युक्तो घातुसाम्यं समं पचन् । *Caraka : Cikitsa* 15 : 51.
- (b) समस्तु स्वस्वपचारतः विकृतिमापद्यतेऽनपचारतस्तु प्रकृतवचतिष्ठते ।
Caraka : Vimāna 6 : 12.
- (c) तत्र यो यथाकालमुपयुक्तमन्नं सम्यक् पचति स समः समैर्दोषैः ।
Suśruta : Sūtra 35 : 21.
- (d) यः पचेत्सम्यग्वाञ्छं युक्तं सम्यक् समस्वसौ ।
Aṣṭāṅgahṛdaya : Śāstrī 3 : 74.

metabolised substances in the body may, in their turn, block the metabolic pathways and inhibit or inactivate the enzymes leading to metabolic—hypotoxic—anoxic conditions, thus, conferring susceptibility to varieties of diseases of metabolic origin.

Tikṣṇāgni—In the case of *tikṣṇāgni*, the quantity of food material digested and made available to tissues are obviously consumed or burnt leaving hardly any material for the synthesis and maintenance of tissues as in case of thyrotoxicosis.

Viṣamāgni—The situation, visualised by this type of disturbances, is difficult to explain.

DHĀTUVĀHA SROTĀMSI

Elsewhere, *annavaha srotāmsi* was discussed in page No. 77 in connection with *āhāra pācana* (digestion of food) and its *śoṣaṇa* (absorption). A reference was then made to two aspects of the concept of *srotas* viz. the *sthūla* or macroscopic, corresponding to the *mahāsrotas* or gastro-intestinal tube and the villi, including the capillaries in them respectively. Earlier, while discussing *bhūtāgni* and *dhātvaṇi pākas*, a reference was also made to *yakṛt*, as an organ concerned not only with the formation of *rakta* but also with several chemical processes involved in *dhātvaṇi vyūpāra*. The distribution of the *poṣaka* or *asthāyi dhātus* (precursor homologues) of several *dhātus* of the body was then stated to be transported to the *sthāyi dhātus* through their specific *srotāmsi*, for their synthesis and maintenance metabolism. Thus, the part played by *dhātuvaha srotāmsi* and the mode of distribution of *poṣaka dhātus* to the *poṣya dhātus*, as envisaged by *Āyurvedic* classics and important commentaries thereon assume importance in the context of this thesis.

The importance attached to *srotāmsi*, in physiological and pathological states, especially, in the description of *samprāpti* or pathogenesis of diseases, can be seen from the emphasis laid on the need to understand their structures, by Caraka, Suśruta and Vāgbhaṭa.

Observes Caraka, "*malas* (waste products) are removed from the *dhātus* and *prasāda* transported to them through the *ayanamukhas* of *srotāṃsi*. These *ayanamukhas* nourish the *dhātu* with appropriate substances to the extent required. ¹

"No structure of the body can flourish or decay independent of *srotāṃsi*. It is undoubtedly the *srotāṃsi* which convey the *dhātus*, which latter undergo transformative changes. *Srotāṃsi* subserve the purpose of transportation. ²

"Nutrient substances which nourish the *dhātus* undergo *pāka* by *āsmā* or *agni* of the *dhātus* and then, they are made available through their respective *srotāṃsi*." ³

The foregoing citations are a few, among the many, which occur in the *Saṃhitā granthas*, but those cited above are sufficient to focus attention on the importance of *srotāṃsi*, as the normal healthy state and functions of the body depends upon the integrity of its internal transport system.

Even so, pathological events are also stated to have their origin at the level of *srotāṃsi*, as can be seen from the following quoted from the three main Āyurvedic Classics. Says Caraka, "The *rasadhātu* is continuously circulated throughout the body being propelled by *vyāna vāyu*. Thus, if *rasadhātu* accumulates in any part of the body due to pathological involvement of the *srotāṃsi* (circulatory channels) abnormal changes are initiated. *Doṣas* in such a condition become localised and initiate the process of disease in their places." ⁴ Says Susruta, "The circulation of *prakupita doṣas* is impeded due to the involvement of *srotāṃsi* where, they react with

1. तेषां तु खलु मलप्रसादास्थानां धातूनां स्रोतास्वयनमुत्थानि । तानि यथा-
विभागेन यथास्वं धातूनांपूरयन्ति । Caraka : Sūtra 28 : 5.

2. सर्वे हि भावाः पुरुषे नान्तरेण स्रोतास्वमिनिर्वर्तन्ते, क्षयं वाप्यभियच्छन्ति ।
स्रोतांसि खलु परिणाममापद्यमानानां धातूनामभिसाक्षीनि भवन्ति अयनार्थेन ।

Caraka : Vimāna 5 : 3.

3. यथास्वेनोष्मणा पाकः शरीरा यान्ति वातवः ।

स्रोतसा च यथास्वेन धातुः पुष्यति धातुतः ॥ Caraka : Cikitsā 8 : 39.

4. क्षिप्यमाणः स्र(स्त्र)वैगुण्यादसः सज्जति यत्र सः ।

करोति विकृतिं तत्र खे वर्षमिव तोयदः ॥ Caraka : Cikitsā 15 : 37.

the *dhātus* and *malas* of the locality and give rise to various forms of diseases from that place."¹ Observes Vāgbhaṭa in his *Aṣṭāṅgahṛdaya*, "In all diseases, *prakupita doṣas* reach the site of the disease (*rogādhiṣṭhāna*) through the *rasāyanis*² and soon cause pathological states."³

Thus, a study in some detail of the internal transport system—both macroscopic and microscopic—through which different kinds of substances are transported to and from *dhātus* or tissues becomes necessary. These include gross channels, such as arteries, veins, lymphatics, respiratory passage, alimentary tract, various ducts which open out internally into several cavities of the body and externally through the skin and other structures. We are at the moment concerned with the study of the more subtler or microscopic channels as distribution of nutrient materials to and the clearance of waste products from the *dhātus* or tissues.

Implication of the term 'Srotāṁsi'—

Earlier, the definition of *srotāṁsi* offered by Caraka, was referred to in the context of the description of *annavahasrotas*.⁴ To recapitulate, the '*srotas*' is so called because of '*śravaṇa*' which takes place in it. The term '*śravaṇa*' means 'to exude', 'to transude', 'to permeate through' or 'to filter through.' The term itself is derived from the sanskrit root 'स्र्' *śr* meaning to exude or to pass through.

The implication of the root-meaning *śravaṇa*, and the definition of *srotāṁsi*, referred to above can be appreciated better by taking into consideration the observations made by Caraka that '*malas*' or waste-products are removed from the

1. कुपितानां हि दोषाणां शरीरे परिपावताम् ।
यत्र संगः स्रवैगुण्याद् व्यापिस्तत्रोपजायते । *Suśruta : Sūtra* 24 : 10.
2. *Rasāyanī* is the synonym of *srotas*.
3. स्रोतांसि, सिराः, वसन्यः, रसायन्यः, रसवाहिन्यः, नाड्यः, पन्थानः, मार्गाः, शरीरच्छिद्राणि संवृतासंवृतानि, स्थानानि, आशयाः, निकेताश्चेति शरीरपाल्ब-
वकाशानां लक्ष्यालक्ष्याणां नामानि भवन्ति । *Caraka : Vimāna* 5 : 9.
4. Page 77.
5. Pā. Dhātup. 965.

dhātus and *prasāda* transported to them by *ayanamukhas* of *srotāṁsi*. These *ayanamukhas* nourish the *dhātus* with appropriate substances, to the extent required. In this view, there are two aspects to the concept of *srotāṁsi*, viz., (1) these are structures through which *sraṇa* or oozing (exudation or filtration) of fluid takes place; (2) they are channels through which body fluids are transported from place to place.¹

Describing the state and forms of *srotāṁsi*, Caraka says that these take the colour of the *dhātus* they transport—they are either tubular, large, minute, elongated or reticulated in appearance.² All these forms and in special the reticulated form of it have a relevancy to this discussion. Even so, the use of the term *ayanamukhāni*, is significant in the identification and description of the functions of *srotāṁsi*. This term is made up of two words viz. *ayana* and *mukha*. Caraka has described *ayanamukhāni* as channels, which are themselves entrances. Cakrapāṇi, in his interpretation of the term *ayanāni*, has stated that this term means channels through which materials travel and *mukhāni*—openings, through which materials enter or make an exit. Therefore, says Cakrapāṇi “the channels and entrances of *dhātus* are not different entities and the same channel serves both as a conduit for the transmission of *prasāda* and *malas* alike.³ It also serves the purpose of their ingress and egress. It would, thus, seem that the term *srotāṁsi* refer to channels which serve both as a conduit as well as the medium through which fluids exude, transude, permeate or filter through. This interpretation is supported both by the *nirukti* and *vyutpatti* of the term *ayana mukha*. The term *ayana* is derived from the root ‘इण गतौ’⁴

1. अयनानि च तानि मुखानि चैत्ययनमुखानि । अत्र आयान्यनेन इति अयनानि मार्गाणि, मुखानि तु येः प्रविशन्ति ।

Cakrapāṇi on Caraka : Sūtra 28 : 5.

2. स्वपातु समवर्णानि वृत्तस्पृष्टान्मणूनि च ।
क्षोतांसि दीर्घाष्वाकृत्वा प्रतानसदृशानि च ॥ Caraka : Vimāna 5 : 25.
3. एतेन मलानां पातूनां च यदेवायनं तदेव प्रवेशमुखमिति नान्येन प्रवेशो नान्येन गमनमित्युक्तं भवति । Cakrapāṇi on Caraka : Sūtra 28 : 5.
4. Pt. Dhātup. 1070.

meaning 'to go' or 'to move', implying "through which something moves." The term '*mukha*' is derived from the root '*मुच्च् मोच्ये*'¹ meaning, 'to leave' or 'to be free.' Amarasīmha has used the term '*खण*' as a *paryāya* or synonym of '*nihsaraṇa*' meaning a structure through which things get out or get in. It is in this context Suśruta's description of *srotāṁsi*, with certain reservations, assume importance. He has described *srotāṁsi* as channels, which have their root or origin in an organ cavity (*chidra*—*Ḍalhaṇa*) and spread throughout the body conducting *rasādī dhātus*. These are different from *sirās* and *dhamanīs*,² which may otherwise resemble them.

The mention, here, of *rasādīdhātus*, which are stated to circulate through the *srotāṁsi* need an elucidation. By *rasādī dhātus* is meant the *sthāyi rasa* cum *rakta* which circulate and transport the *poṣaka* or *asthāyi dhātus* to other *poṣya* or *sthāyi dhātus*. The fluid that circulates through *dhamanīs* and *sirās* which have their origin in the *hṛdaya* or heart, is stated to be *rasa*.³ This fluid is the vehicle which carries nutrients to all the tissues of the body and it is this fluid, again, which exudes, filters and diffuses through the *ayana mukhas* of the *srotas*. A distinction between the circulating *rasa* and *rakta* cannot obviously be drawn as the fluid that circulates in the *dhamanīs* and *sirās*, is a composite whole and a complex-flowing tissue composed of the *sthāyi rasa* and *rakta*. It is significant to note here that *Āyurvedasūtra*, a fifteenth century work has advanced the view that "*rasa* itself is *rakta*,"⁴ *rakta* is *rasa*⁵ and *rakta* is both *rasa* and *rakta*.⁶ In addition, pro-

1. Ps, Dhātup. 1455.

2. (a) मूलाव खादन्तरं देहे प्रसृतस्त्वभिवाहि यत् ।

स्रोतस्तदिति विज्ञेयं शिराषमनिर्वाहितम् ॥ *Suśruta : Śāstra* 9 : 13.

(b) मूलाव खादिति हृदयादिच्छिद्राव । *Ḍalhaṇa* on above.

3.सम्यक्परिणतस्य यस्तेजोभूतः सारः परमसूक्ष्मः स रसः शस्यच्यते । तस्य हृदयं स्थानम् । *Suśruta : Śāstra* 14 : 2.

4. रसो वासुक् । रसो वै सः । *Āyurvedasūtra : Prasna* 2 : page 100.

5. असुगेव रसः । *Ibid : Prasna* 8 : page 25.

6. असुगेव रसासुक् । *Ibid*.

ceeding on the basis of *adhikarāṇa siddhānta*,¹ the fluid that is drawn in *raktamokṣaṇa* is red and it is pumped or thrown out as it were by *hṛdaya*. This fluid is both *rasa* and *rakta*, in the sense that *raktadhātu* while being transported by *rasa-dhātu*, during its *vikṣepaṇa* imparts to the latter its characteristic red colour. Cakrapāṇi Datta has also recognized *hṛdaya* as the seat of *rakta*.²

Dhamanīs are also stated to be the medium, through which *ojas* is made available to *dhātus*. They (*daśamahāmūladhamanīs*) emerge from *hṛdaya*.³ *Rasa*⁴ and *rakta* are also, *paryūya padas* (synonyms) of *ojas*. It will be relevant to note here that, both *Ḍalhaṇa*⁵ and Cakrapāṇi,⁶ commenting on the term "*Dhātugrahaṇanīḥṣṭam*" in connection with *ojovisraṁsa*, *ojovyūpat* and *ojahkṣaya*, have interpreted this term as *dhātuvaha srotas*. Cakrapāṇi has in addition stated that their *srotāṁsi* are also *ojavāhinīs*. It would thus seem that the *daśamahāmūladhamanīs*, which emerge from the heart and spread throughout the body giving off ever smaller branches ultimately end as *srotāṁsi* which perform must be extremely subtle tubes with innumerable openings or pores in their walls, through which *rasa sravaṇa* takes place. In this sense, *srotāṁsi* would demarcate and line the *dhātus* and answer to the description of *kalās* viz., *dhātuvāsayāntara mārṇyāda*.⁷

The importance of the foregoing conclusions will be

1. तत्र यमयमधिकृत्योच्यते तदधिकरणम् । *Sūtrata : Uttara Tantra* 68 : 8.

2. रक्तादीनां तु सर्वशरीरचरणानपि विशेवेण हृदयं स्थानमुक्तम् ।

Cakrapāṇi on *Caraka : Cikitsā* 24 : 36.

3. तेन मूलेन महता महामूला मता दश ।

ओजोवहाः शरीरेऽस्मिन् विद्यम्यन्ते समन्ततः ॥ *Caraka : Sūtra* 30 : 8.

4.रसश्चैव संख्यातः..... । *Caraka : Nidāna* 4 : 7.

5. धातुग्रहणमिति धातवो गुह्यन्ते यैस्तानि धातुग्रहणानि धातुवाहीनि स्रोतांसि, तेभ्यो निःसृतं निर्गतं सर्वधातुस्तेहपरम्परारूपेण; अथवा धातुग्रहणं हृदयं धातुवह-स्रोतसां स्थानत्वात्, तस्माद् हृदयाभिःसृतं स्रोतसो मुखैरेव ।

Ḍalhaṇa on Sūtrata : Sūtra 15 : 23.

6. धातवो गुह्यन्ते यैस्तानि स्रोतांसि ओजोवाहीनि । Cakrapāṇi on the above.

7. कलाः स्रवपि सप्त भवन्ति धातुवाशयान्तरमर्वादाः । *Sūtrata : Sūtra* 4 : 5.

readily appreciated by the fact that Caraka has described the characteristic features of *dhamanīs*, *srotāṁsī* and *sirās* in the context of the description of the mode of distribution of *ojas* to all parts of the body.....". They are spoken of as *dhamanīs* because they pulsate, as *srotāṁsī* because they permit oozing and *sirās* because they maintain continuous flow"¹ obviously of *rasa* and *rakta*.

This passage is significant in the sense that it describes in simple terms different aspects of circulation in which the heart occupies a central position comparable to a pumping station. The order of enumeration of *dhamanīs*, *srotas* and *sirās* is also seen to be meaningful and purposive. No doubt there exist morphological and functional differences between *dhamanīs*, *srotas* and *sirās*, which, according to Caraka's definition would appear to correspond to arteries, capillaries and veins respectively. The unity and diversity of these three component parts of the circulatory apparatus can be seen from the fact that the heart and the entire vascular system have been shown, to be lined with a single continuous layer of smooth flat epithelial cells. These constitute the entire internal wall of blood and lymph capillaries, but in larger channels muscle and fibrous elastic tissues envelop the lining layer the wider the vessel thicker is the wall. Arteries which bear the burnt of internal fluid pressure are particularly thicker as compared to veins and lymph vessels. Arterial blood flows in rhythmic spurts, in keeping with the rythm of the heart. As each spurt of fluid impinges on the wall of arteries, it gives rise to pulse vibration (*dhmāna*). Likewise as the distance from the heart increases, the arterial spurt becomes less and less powerful. By the time blood, through the capillary vessels, reaches veins, it no longer spurts but flows in continuous even stream. Thus, *hṛdaya*, *dhamanīs*, *srotāṁsī* and *sirās*—including *rasavaha srotāṁsī*—constitute a single circulatory unit, which regulate the proper flow of blood, supply nutrition to and remove waste-products from *dhātus*.

1. धमनाद धमन्यः, स्रवणस्रोतांसि, सरणासिराः । Caraka : Sūtra 30 : 12.

The reason, why Suśruta sought to exclude *sirās* and *dhamanīs* from the description of *srotāṁsi*, will become clear by taking into consideration the fact that endocardium which is made up of a single layer of endothelial cells which as the tunica intima of large arteries like 'Aorta', medium sized arteries like the 'femoral' and small arteries like dorsalis pedis, arterioles, etc. finally end as capillaries and continue beyond as the tunica intima of veinules, small veins, medium sized veins and big veins which finally end as the endocardium of the heart. Even so, the lymphatics which commence at the level of the tissues are also lined by endothelial cells and finally end in the heart. *Sravaṇa* does not take place either from a *dhamanī*—big, medium or small or from *sirās* (veins) likewise, but it actually occurs at the level of *srotāṁsi*, which are both *ayanas* and *mukhas*.

The *dhātuvaha srotāṁsi* can now be compared with the endothelial walls of capillaries with sufficient justification. Capillary walls have been shown to be composed of endothelial cells joined at edges to form a tube. These cells are not similar to other types of cells in that they possess the property of being semi-permiable, that is to say, they exercise selective discrimination in permitting certain materials to enter through them, while denying entry to others. The dimension of the capillary wall is one cell larger thick. They are made up of intercellular pores corresponding to the description of *mukhāni* of *srotāṁsi*.

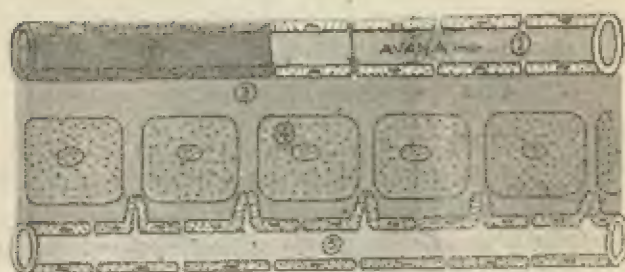
Capillary system and dhātuvaha srotāṁsi—

Capillaries, like *srotāṁsi*, are extensively minute tubes that lie between the arterioles and veinules, the space between the two, being occupied by tissues or *dhātus* and tissue spaces filled with fluid. The diameter of a capillary is less than that of a hair, so that, in many of them red blood corpuscles may have to pass through in a single file. Their diameter varies from 5 to 20 microns and about 0.5 mm. in length.

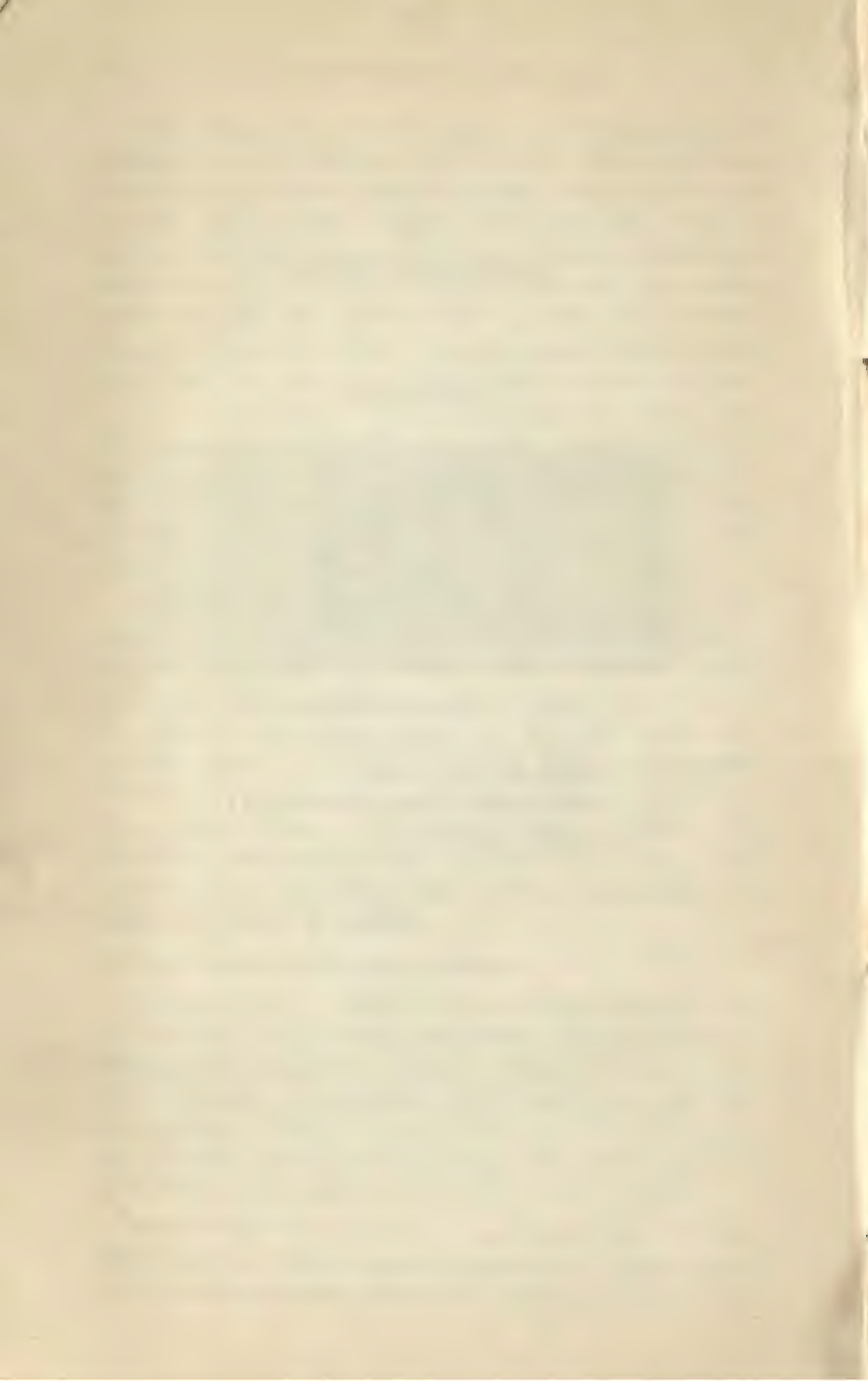
The function of capillaries is apparently determined by their structure. This is specially important having regard to the two-fold functions ascribed by *Ayurveda* to *srotāṁsi* viz.

IX DHĀTUVĀHA SROTAS

ĀYANAMUKHA



- (1) ARTERIAL END OF THE CAPILLARY
- (2) VENOUS END OF THE CAPILLARY
- (3) TISSUE FLUID (LASIKĀ)
- (4) TISSUE CELLS (DHĀTUPARAMĀNUS)
- (5) LYMPH (LASIKĀ)



ayana and *mukha*. As mentioned earlier the capillary walls are composed of merely a single layer of that endothelial cells joined to one another at their edges by a cement substance which is considered to be made up of a mesh of calcium proteinate. Nutrient materials—*poṣaka dravyas*—and oxygen—*vi jātiya tejas*—pass out from capillaries to the tissues and carbon-di-oxide—*malarūpa vāyu* and other breakdown products of metabolism—*dhātumalas*—enter the blood-stream and they are carried away.

The space between the capillary wall and tissue-spaces is filled with tissue fluid which filter or oozes through the wall—*sravaṇa*—through *ayanamukha* of *srotāṃsi-capillaries*. This fluid is derived from blood plasma—*sthāyi rasa dhātu*.

A system of lymph vessels drain the fluid from extra cellular spaces and this fluid in lymph vessels (*rasāyanis*) is known as the 'lymph.' There is in fact no difference between the tissue-fluid and lymph. It may be noted that blood passing through tissues is really confined to capillaries and in the normal course of events, it does not come in direct contact with cells i.e. *dhātus*. The lymph or tissue fluid on the other hand is in the tissue spaces outside the capillary wall and it is this fluid that baths tissue cells.¹ Not only this, it acts as a medium of exchange between blood and tissues. *Poṣakadravyas* or nutrient materials pass through capillary wall and are carried by tissue fluid to cells. Even so, waste-products of cell metabolism, i.e. *kiṭṭa* that arise out of *dhātvagni pāka* pass from the tissue or *dhātu* to tissue-fluid which is then absorbed into the blood stream and carried away. The *rasāyanyaḥ* (lymphatic) system represent an one way traffic. Its function is to gather tissue-fluid and not to distribute it. Smaller *rasāyanis* join together to form large ones and in their turn they ultimately drain into veins or *sirūṣ*. At this point *rasa* or lymph once again becomes part of *rakta* or blood and is distributed by arterial or *dhamani*

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1. स रसः इत्युच्यते, तस्य हृदये स्थानं, स हृदयात् चतुर्विंशतिषमनीरनुप्रवि-
श्योर्ध्वं दश दशाधोगामिन्यः चतस्रश्च तिर्थेभ्यः कृत्स्नं शरीरमहरहस्तपैयति,
वर्षयति, धारयति, वापयति चादृष्टहेतुकेन कर्मणा । *Suśruta : Sūtra 14 : 3.*

system. Lymphatic capillaries are wider and irregular as compared to the blood capillaries. They anatomose to form elaborate plexuses or become reticulated.

Specificity of srotāṁsi—

Saṁhitā granthas have correlated *srotāṁsi* with *dhātus* and have described them by the name of *poṣaka dhātu*, they carry and the *sthāyi dhātus* to which they are conducted. Thus, there are references to *rasavaha srotas* and *raktavaha srotas* etc. Earlier in page 91 it was noted that *prasāda* portion of the final precursor products of *prasāda pāka* of *dhātuvāgni vyūpāra* are transported through specific *dhātuvaha srotāṁsi* to particular *dhātus* to which the *poṣakadhātus* are meant to be supplied. Thus, the nutrient needs by *māṁsa dhātu* of specific substances is channeled through *māṁsavaha srotas* whereas the specific *srotāṁsi* of *majjā* can transport and supply specific substances required for this *dhātu*. In other words, each *dhātuvaha srotāṁsi* can be said to be able to exercise a selective discrimination and specificity as regards substances, they carry to specific kinds of tissues.¹ This view finds support from modern scientific researches. According to Abraham White *et al*, "Although consistent with many observed facts Starling's concept of exchange of materials between the arterial and venous branches does not account for the difference of exchange among various tissues. Additional factors are the structure of the membrane which separate capillaries from tissue-spaces, and rapid diffusion along the length of the capillary. Insight into the differences in the nature of the walls of glomerular capillaries and the capillaries of striated muscle has been gained by comparative measurements of the rates of diffusion of water and solutes between the vascular bed and the extracellular spaces of kidney and muscle. In these studies the permeability to water was found to be hundredfold greater for the glomerular capillaries than for those of muscle. These results were most readily accounted

1. न चान्यस्रोतसाऽन्यथागुप्तिः संभवति, सर्वोप्याणां भिन्नदेशत्वात्, न ह्यभिन्नेन स्रोतसा भिन्नदेशवृत्तयोः सेचनमस्ति ।

for by assuming the presence in the capillary wall of pores, the number of which per unit area, as well as their shape and dimensions, can be assumed to vary according to the tissues in which the capillaries are found. (Italics mine). Thus, the Starling concept, which assumes the ultra filtration of blood constituents, is modified to include the concept of porous capillary wall, with pore numbers, dimensions and shapes varying in capillaries of diverse tissues and operation of a rapid diffusion process across the capillaries.¹

Modern trends as regards the specificity of capillaries as represented by the views of Abraham White *et al* extracted above will highlight the old *Āyurvedic* view that *srotāṁsi* are specific in their nature and function, according as, the nature of the *poṣaka dhātus* they transport and the *dhātus* to which they supply.

The relevancy of a discussion on *srotāṁsi*, arises in view of the *Āyurvedic* doctrine that *agni-dūṣṭi* may involve *dhātus*, resulting in an accumulation in them of *malas* or *doṣas* as they are called. This has been stated to be preceded by *kha-vaiguṇya* (*sroto-vaiguṇya*) leading to *srotorodha* and, in consequence, the obstruction to the free flow and circulation of normal *doṣas* and *dhātus* and the retention of *malas* or *doṣas* in the *dhātu* concerned, leading to an inter-action between the *doṣas* and *dhātus* of the locality where, obstruction has taken place. This phenomenon has been described as *doṣa-dūṣya-sammūrchanā*. The site, where *doṣa-dūṣya-sammūrchanā* takes place, has been stated to be the site where the process of disease is initiated corresponding to the *sthāna saṁśraya* phase² of *kriyākālas*.

Adverting to the doctrine that moities of *pācaka* (*pācakaṁśa*) permeate the *dhātus* and augment the function of

1. Abraham White *et al* : "Principles of Biochemistry" 1954 edition; page 734.

2. एवं कुपितास्तास्तान् शरीरप्रदेशानागत्य तास्तान् व्याधीन् जनयन्ति । ते यदोदरसन्निवेशं कुर्वन्ति तदा गुल्मविद्रध्युदराग्निपक्षानाद्विसृज्ज्वातिसार प्रभृतीन् जनयन्ति, वस्तिगताः प्रमेहाश्मरीमूत्राघातमूत्रदोषप्रभृतीन्, मेदङ्गता निरुद्धप्रकशोपदर्शशुक्रदोष प्रभृतीन्..... । *Sūtrata* : *Sūtra* 21 : 37.

sthānika pitta must take into consideration the fact that even *srotāṁsi*, that answer to the description of *kalās* which form some of the vitally essential structures of our body corresponding in general to epithelial tissues (endothelium) have metabolic functions to perform in consequence of their vital activities. In cases of *agnimāndya* or the *duṣṭi* of *pācākāgni* it can be logically expected that the *pācākāṁśas* in *srotāṁsi* too may be deficient leading to abnormal functioning of them corresponding to *kha-vaiguṇya* or functional impairment of *srotāṁsi*. This may be expected to result in the obstruction and occlusion of these vitally important structures resulting in the stasis of *poṣaka dhātus* in circulation and the clearance of *malas* from the related *sthāyi dhātus*. In other words '*srotorodha*' is thus caused. This may be manifested as, described by Caraka, in either an excessive flow (*atipravṛtti*) as in *bahumūtra*¹ or polyuria, resembling *prameha* or diabetes mellitus and insipidus etc. Another example given in the context is *atisāra*² or diarrhoea or diminished flow (*saṅga*) as in *mūtrakṛcchra*³—anurea—and frequent voiding of faeces in small quantities of the contents of the affected *srotāṁsi* or their dilation (*granthi*) or diversion of the fluid circulating in the affected *srotāṁsi* through different other channels according to the nature of the involvement of the *srotāṁsi* i.e. *srotoduṣṭi*.⁴ This would, in effect, mean a heightened permeability resulting in the leakage of materials from *srotāṁsi* or retension of fluid leading to back-pressure and dilatation or the fluid being moved through collaterals to parts other than those to which they supply. Thus, impairment of *agni* may in turn contribute to *srotoduṣṭi* and initiate the process of disease in the site of such occurrence.

1. अतिशयेन प्रवृत्तिर्वा मूत्राद्विस्तीर्णतां प्रमेहश्च मूत्रता ।

Arūpa Datta on *Apārāṅgahṛdaya* : *Sūtra* 3 : 45.

2. शक्नुवाहोनां स्तीर्णतां अतिसारवत् पुरोवातिसरणमतिप्रवृत्तिः । *Ibid.*
3. सङ्कोऽप्रवृत्तिः । किञ्चिदा प्रवृत्तिमूत्रकृच्छ्रवत् ।सङ्कोः स्तीर्णं कृत्वा पुरोवस्य प्रवृत्तिः, जयवा सर्वथोदावर्तवत् पुरोवस्याप्रवृत्तिः । *Ibid.*
4. (a) अतिप्रवृत्तिसङ्को वा सिराणां ग्रन्थयोऽपि वा ।

विमार्गगमनं चापि स्तीर्णतां दुष्टिकक्षणम् ॥ *Caraka* : *Vimāna* 5 : 24.

- (b) *Apārāṅgahṛdaya* : *Sūtra* 3 : 45.

Classical books on *Āyurveda* have treated both *agnimāndya*¹ as well as *srotoduṣṭi*² as factors responsible for the causation of diseases. In the view of the author of this thesis the order of occurrence of disease process should include first *agniduṣṭi*, and *srotoduṣṭi* follows as its effect. This has an immediate bearing on *Āyurvedic* therapeutics, as it is seen that *pañcakarma* measures aim primarily at the correction of *agniduṣṭi* before embarking upon treatments meant to remove *srotoduṣṭi*.

ĀMADOṢA

In the *Āyurvedic* view, nearly all diseases, included under *Kāyacikitsā*, have their origin in *āmadoṣa*. *Āmadoṣa* and *āmaviṣa* are conditions which are stated to occur due to the impairment of *kāyāgni*. It was seen earlier that the *kāyāgni*, in its narrower sense relates to factors concerned with gastro-intestinal digestion and in its wider sense to metabolic events of the body. *Āmadoṣa* or *āmaviṣa*, both as acute and sub-acute or chronic conditions appear to relate to the gastro-intestinal as well as metabolic disturbances engendered due to the impairment of *antarāgni* or better still *agniduṣṭi*. The basic doctrines of *Āyurveda* as regards health and disease revolve round nutrition and its utilisation by the body under the influence of *agni*. Its theories of pathogenesis are also co-related to the type of nutrition available and the functional states of *agni*. Generally speaking, *āma* has been defined as a condition in which the first *dhātu*, namely *rasa* is not properly formed due to the lowered strength of *āṣmā* (*agni*).³ On the other hand, in this state, the food

1. (a) रोगाः सर्वेऽपि मन्देऽग्नी..... । *Aṣṭāṅgahṛdaya* : *Nidāna* 12 : 1.
 (b) अग्निदोषान्मनुष्याणां रोगसंघाः पृथग्विधाः ।
 मलवृद्धया प्रवर्तन्ते..... । *Caraka* : *Cikitsā* 13 : 9.
2. (a) क्षिप्यमाणः खवैगुण्यद्दसः सज्जति यत्र सः ।
 करोति विकृतिं तत्र..... ॥ *Caraka* : *Cikitsā* 15 : 39.
 (b) *Suśruta* : *Sūtra* 24 : 10.
 (c) *Aṣṭāṅgahṛdaya* : *Nidāna* 1 : 23.
 (d) *Ibid* : *Sūtra* 3 : 69.
3. कम्पणोऽल्पबलत्वेन धातुमाद्यमपाचितम् ।
 दुष्टमामाश्रयगतं रसमार्मं प्रचक्षते ॥ *Aṣṭāṅgahṛdaya* : *Sūtra* 13 : 25.

ingested becomes *duṣṭa*. According to other authorities, quoted by Vāgbhaṭa, the impaired *vātadi doṣas* become mixed up with one another, leading to the formation of *āmadoṣa*, very much like the production of *viṣa* from the spoiled *kodrava*.¹ The general outlook of the two descriptions of *āmadoṣa* would appear to be that in the absence of or due to the inhibition of *kāyāgni* the ingested food is not properly digested. Products which arise out of such an impaired digestion is retained in the *āmāśaya* and they undergo such changes as yield toxic substances which are known as *āma*. The etiological factors of *āmadoṣa* as described by Caraka and Suśruta, are the following and this range from diatetic indiscretions including errors of nutrition to emotional tensions of different kinds.

I. Diatetic indiscretions—

- (i) Abstinence from food
- (ii) Indigestion
- (iii) Over-eating
- (iv) Ingestion of
 - (a) Unwholesome food
 - (b) Heavy or indigestible food
 - (c) Cold and stale food
 - (d) Excessively dry dehydrated food
 - (e) Putrid articles.

II. Adverse effects of Therapeutic measures viz.

- (i) Purgation
- (ii) Emesis
- (iii) Oleation

III. Emaciation or wasting brought about by other diseases.

- #### IV. Incompatibility of the
- (i) Country
 - (ii) Climate
 - (iii) Season

1. अन्ये दोषेभ्य एवाति दुष्टेभ्योऽन्योन्यमूर्च्छनात् ।

कोद्रेभ्यो विषत्वेन वदन्त्यामस्य सम्भवम् ॥

V. Volitional inhibition of natural urges. ¹

VI. Mental tensions and emotional instabilities like

- (i) Envy, impatience
- (ii) Fear Complex
- (iii) Anger, rage
- (iv) Greed
- (v) Pessimistic outlook
- (vi) Enmity. ²

The aetiological factors mentioned above apart, note has to be taken of several definitions and descriptions of *āmadoṣa* furnished by Vijayarākṣita in his *Madhukoṣa* commentary on *Mādhava Nidāna*.

(i) "The term *annarasa* means *āma*. If *annarasa* is not properly digested and formed, then the outcome of such a digestion is known as *āma*." ³

(ii) "In the view of some, due to the impairment of *kāyāgni*, the *annarasa* is not properly formed in the *āmāśaya* and in this state, it is known as *āma*." ⁴

(iii) "There are others who hold that the undigested *annarasa* possessing foul odour and excessive pastiness depri-

1. अमोजनादजीर्णातिभोजनादिवमाशनात् ।

असाम्यगुरुशीतातिरुक्षसंदुष्टमोजनात् ॥

विरेकवमनस्नेहविभ्रमादथाधिकर्षणात् ।

देशकालतुर्वैषम्यादेगानां च विषारणात् ।

दुष्पस्वप्निः.....

॥ Caraka : Cikitsā 15 : 42-43.

2. (a) ईर्ष्यामयक्रोधपरिक्षतेन जुम्हेन रुग्दैर्न्यनिपीडितेन ।

प्रदेशयुक्तेन च सेव्यमानमन्नं न सम्यक् परिपाकमेति ॥

Sūtrata : Sūtra 46 : 535.

(b) कामकोषलोभमोहेर्ष्याहीनोऽकमानोद्देगभयोपतप्तमनसा वा यदन्नपानमुप-
युज्यते, तदप्याममेव प्रदूषयति । Caraka : Vimāna 2 : 8.

3. सोऽन्नो रस इति आमः, अन्नरसस्यैवापकस्य तन्मान्तरे आमस्यपदेशात् ।

Madhukoṣa on Mādhavanidāna 25 : 5.

4. आमाशयस्थकायाग्नेर्दौर्बल्यादविपाचितः ।

आद्य आहारबालुर्यः स आम इति कीर्तितः ॥ Ibid.

ves the body of its nutrition and in consequence causes *sadana*. This is known as *āma*.”¹

(iv) Some hold the view that if due to the poor strength of *jāḥarāgni* a residue of *āhāra rasa* is still left behind undigested towards the end of digestion; it is then known as *āma*, which is the root cause of all diseases.”²

(v) “The view that the food which is not properly digested is *āma*, is held by some. Yet, others describe the accumulation of *malas* in the body as *āma*.”³

(vi) “There is also the view that the first stage or phase of *doṣa-duṣṭi* is *āma*.”⁴

The mention made by Caraka of the *śukratva*⁵ which the food is stated to undergo and its behaviour as *viṣam* studied together with the mention of *daurgandhya* and *bahu picchilatva*, made by Vijayarakṣita in his reference to other views held on the subject as also the mention made by Vāgbhaṭa to *āmaviṣa* as a serious toxic condition comparable only to acute stages of poisoning which exhibits a symptomatology comparable to *viṣa* may endanger life and therefore, to be treated fatal prognosis⁶ need an appraisal.

Implication of the term 'śukratva'—

The term *śukratva* refers to sourness. *Śuktapāka* means a chemical reaction that results in the productions of acids (tasting sour). It will be recalled that the term *amlapāka* was used by Caraka while describing the second *avasthāpāka*. This reference would imply the outcome of normal digestive reactions that occurs in the stomach in which certain

1. अपरे त्वाहुः—अविपक्वसंयुक्तं दुर्गन्धं बहुपिच्छिलम् ।

सदनं सर्वगात्राणामाम इत्यभिधीयते ॥

Madhukāśa in Madhava-nidāna : 25 : 5.

2. अन्ये त्वाहुः—आहारस्य रसः शेषो योनपक्वोऽग्निलाघवाद् ।

स मूलं सर्वरोगाणामाम इत्यभिधीयते ॥ Ibid.

3. आममत्ररसं केचिद् केचित्तु मलसंचयम् । Ibid.

4. प्रथमो दोषदुष्टिश्च केचिदामं प्रचक्षते ॥ Ibid.

5. Caraka : Cikitsā 14 : 44.

6. आमदोषं महाघोरं वज्रैरेदिपतञ्जकम् ।

विषरूपाशुकारित्वादिरूपकमस्त्वतः ॥ Astāṅgahṛdaya : Sūtra 8 : 14.

components of food are acted upon by *dravyas* present in this place which are *amla* and therefore *āgneya*¹ in nature. It should be noted that even though *śuktapāka* yields substances which are also *amla*, or sour, this term has not been used in the context of normal gastric digestion. The obvious inference to be drawn from this is that the latter term relates to the outcome of abnormal digestive reactions which yield substances having sour taste.

It was pointed out while discussing *avasthāpāka* that certain components of food assume *madhura pāka* and certain others *amlapāka* during the stage of *prapāka* or *prathama pāka*. These were then shown to be starch and proteins. In the case of *śuktapāka* starches undergo fermentative change yielding vinegar-like substances with the difference that the fermentation of sugars in the stomach or intestine under the influence of bacterial enzymes yield various bi-products of fermentation of carbohydrate viz. butyric acid, acetic acid etc. *Āmadoṣa* in which food attain *śukta* obviously relate to the fermentation of sugars brought about by bacterial agents which latter have become active due to the loss of *agni* balance. These products are toxic.

Daurgandhya and Bahupicchilatva—

Even so, the decomposition of such organic substances as proteins under the influence of micro-organisms is accompanied by the development of disagreeable odours and products produced, in this process include gases such as ammonia, hydrogen sulphide, methane and others; toxic substances such as indol, sketol, phenol and others, in addition to codaverine² and putrescein which are toxic products and known as protamines. Likewise the mass of proteins which has

1. वृषिक्यनिर्भूयिष्ठत्वादम्भः । *Caraka : Sūtra* 26 : 40.

2. Pentamethylenediamine, a ptomaine formed by the action of the vibrio comma on protein. 'New Gould Medical Dictionary,' p. 189. Tetramethylene diamine, a product of decarboxylation of ornithin and also, found in putrifying flesh, formerly believed to be responsible for food poisoning and referred to as ptomaine. (Ibid).

been subjected to putrefaction is also very slimy having been degraded in this process.

Sahaja Kṛmis or intestinal flora—

This brings us to an enquiry as to what part bacteria contribute to the *nidāna* of *āmadoṣa* or *āmayiṣa*. This issue will be appreciated better by an appreciation, if *Āyurveda* had recognised *kṛmis* or pathogenic organisms as the cause of disease. It is significant to note that Caraka, while describing twenty kinds of organisms which are pathogenic also made a reference in passing to innumerable *sahaja kṛmis* or normal organisms which are present in the body.¹ His commentator Cakrapāṇi has described *sahaja kṛmis* as *avalkārikas*² or non-pathogenic. The question will now arise if these *avalkārikā* or *sahaja kṛmis* are normal inhabitants of the body, what function they perform in the normal course of events? Following on this, two other questions will also arise viz. (a) whether these *kṛmis* lead a parasitic existence at the expense of their hosts by living on their nutrients or (b) they lead a saprophytic existence drawing their pabulum from the waste products or *malas* of their hosts? Answers to these questions are not found in the available editions of the *samhitāgranthas*. Hence, it is necessary to take advantage of modern developments in the field of microbiology, to secure a better understanding of the role, the *sahaja kṛmis* play in normal states of health and contributions they make to abnormal states as well.

According to these developments virtually every animal possessing *mahāsrotas* or *koṣṭha* (alimentary canal) harbours billions of intestinal bacteria more specially in the large intestine. They freely draw upon materials which are either not digested or are indigestible by their host. As a result of their activities, these bacteria contribute to faecal decay.

1. इह सप्तवधिवेश ! विशतिविधाः कुमयः पूर्वमुद्दिष्टा नानाविधेन प्रविमान-
नान्यत्र सहजेभ्यः । Caraka : Vimāna 7 : 9.
2. अन्यत्र सहजेभ्य इत्यनेन शरीरसहजास्त्ववैकारिकाः कुमयो विशतेरप्यधिका
भवन्तीति दर्शयति । Cakrapāṇi on above.

Under conditions of health bacteria cannot thrive in the stomach due largely to a *drava* secreted in the place which possess *āgneya* properties viz., hydrochloric acid. Bacteria, as may enter the body together with food and drinks, are destroyed by the action of this acid. Nonetheless, a few of them which may manage to escape and survive are swept into the intestine and they gradually manage to find an asylum in the *bṛhadantra* or *pakvāsaya* where the climate for their survival is more congenial.

It has been shown that *bṛhadantra* compared to *kṣudrānta* is protected sufficiently to resist the passage of toxic substances into the blood stream. By implication, the *kṣudrānta* is relatively less protected to prevent the passage of poisonous substances into the blood stream. In other words, even though highly poisonous substances are formed in the *bṛhadantra* by the activities of some of these bacteria, the immunity which this portion of the *mahāsrotas* enjoys generally prevents mischief.

It has been shown that the population of *sahajakṛmis* that inhabit the *kṣudrānta* are different from those of *bṛhadantra*. These organisms known as *bacillus Bifidus*, perform fermentative and not putrefactive action. The climate of the *uṇḍuka* region (ileo-cecum) is generally *amla* or acid due to the nature of its contents which is inimical to the growth and activities of proteolytic *kṛmis*. Ordinarily, so long as the supply of carbohydrate material is adequate, the inhabitants of *uṇḍuka* region flourish. Any other bacteria as may make an excursion into the *kṣudrānta* are thus prevented from getting a foot-hold in this region.

There are, however, certain conditions, especially in infants in whom the immunity of the *kṣudrānta* is less than that of the adults, a severe type of toximia, presenting the symptoms of *āmātisāra* and characterised by *vamana*, *atisāra*, *ambukṣaya* (dehydration), extreme *dīnatva* (prostration) take place. This condition is stated to be caused by an extension of some of the population of *bṛhadantra* into the *kṣudrānta*. By way of treatment of such conditions measures

are directed towards encouraging the normal acid producing organisms to gain the upper hand. Thus, a liberal supply of carbohydrate especially in the form of lactose is made available for this purpose. This form of carbohydrate reaches further down, to the *uṇḍuka* region as compared to other forms of carbohydrates before it is absorbed. Another interesting method reminiscent of the administration of *takra* in such conditions is the administration of cultured fermentative organisms such as those of sour milk namely *bacillus Bulgaricus*.

It may be noted here that the microbes of large intestine or *bṛhadantra* perform two types of actions namely fermentation and putrefaction. The former term describes the action of a living organism in causing *bhinna-saṁghāta* or the split of complex substances into their simplest components. An outcome of bacterial fermentation is the production of different kinds of gases. This may be illustrated with the example of the preparation of *āsavas* and *aśiṣṭas*. It may be noted here that some products are much more readily fermented in this manner than others. Putrefaction, on the other hand, is a like process and resembles in many ways fermentation with the difference that it refers specifically to *bhinna-saṁghāta* of protein substances rather than carbohydrates into smaller molecules with the liberation of various disagreeable or foul smelling gases such as indol, skatol, phenol, hydrogen sulphide and ammonia etc. The term putrefaction itself means to make rotten.

Apart from the contributions these *sahajakṛmīs* which normally inhabit the *bṛhadantra* are said to make to the welfare of the hoast to which a reference was made earlier the previous paragraph they may, by entering into *kṣudrāntra* and *ūrdhva āmāśaya* specially when *agnibala* is considerably reduced, contribute poisonous substances by putrefying the protein constituents of food. These may be more easily absorbed from *kṣudrāntra* together with faultily formed *rasa* leading to toxæmic conditions answering to the description of *āmaviṣa*.

Events, specially the abnormal conditions visualised above may intoxicate cells which constitute the *dhātuvahasrotāṁsi*,

thus bringing about *kha-vaigunya* which latter may lead to *sratorodha* leading in turn to an interaction between the abnormal *doṣas*, *sthānika dhātus*, *doṣas* and *malas* leading to the creation of *malasañcaya* or *doṣacaya* in that locality and thus, to initiate the process of disease. The condition envisaged above corresponds to the description of metabolic-hystotoxic anoxia described earlier in page 116.

ĀMA FORMATION DUE TO DHĀTVAGNI MĀNDYA

It is seen that Ḍalhaṇa¹ and Cakrapāṇi,² in their commentaries on Suśruta have stated that the formation of *āma* need not necessarily be due to *jāṭharāgni māndya* only, and it may also occur due to the impairment of *dhātuvagnivyāpūra*. It is also seen from *Ātaṅkadarpaṇa*³ commentary of *Mādhavanidāna* that *āmadoṣa* may be caused due to *māndya* of *dhātuvagnis* and *bhūtāgnis*, on account of which *śoṣa*, *vraṇa*, *vidradhi* and such other diseases may be caused. It is necessary to bear in mind at this point that the term '*dhātu*' used in this context by Ḍalhaṇa, Cakrapāṇi and Vācaspativaidya, refer to *asthāyi* or *poṣaka dhātus* and the *agni* referred to in this context is *dhātuvagni*. In contrast, the *agni* present in *sthāyi* or *poṣya dhātus* are *pācakaṁśas*. While, *jāṭharāgni pāka* refers to digestive events, the *dhātuvagni pāka* relates to intermediary metabolism and *pākas* carried out by these *pācakaṁśas* in *sthāyi dhātus* relate to the synthetic and maintenance metabolism in them. The *vaigunya* of *dhātuvagni* referred to by Ḍalhaṇa, Cakrapāṇi and Vācaspativaidya, leads to the impairment of intermediary metabolism resulting in the production of incompletely metabolised substances which are obviously not

1. कथं रसश्चापकश्चेति विरोधनीयं वचनम् ? न ह्यपको रसः व्यपदेशं लभते । सत्त्वं, जाठरेणाग्निना रसः कद्गावेन कृतपव, किन्तु चास्वप्तिमिरपाकादाम इत्युच्यते । Ḍalhaṇa on Suśruta : Sūtra 18 : 35.
2. आमपद इति द्वयार्थेऽयमेवशब्दः रक्तादिरूपेणापरिणततयाऽयक इव इत्यर्थः ; न तु 'आमाशयस्वः कायान्नेदौर्बल्यादविपाचितः' इत्यादिना उक्तः, तस्य रोगहेतु-त्वाऽऽमाशयस्वत्वेन च मेदोजनकायोगात् । Cakrapāṇi on above.
3. एतावता धातुभूताग्रोनां मान्द्यत्वेनामसंभवात् शोषव्रणविद्रव्यादिरोगाणां तच्चान्यत्त्वमुक्तं भवति..... । यत्र धातुपदेशे बहिर्मेन्दो भवति तत्रैवामसंभवात् पीडकापत्तिः स्यात् । Ātaṅkadarpaṇa on Mādhavanidāna 6 : 22.

fit for utilisation by the *sthāyi dhātus*. Thus, these products are in *āma* state and cause *āmadoṣa* at this level.

The clarification offered above may be amplified thus : *Dhātvaṅni pāka*, it is obvious, furnishes the elements necessary for the synthesis of *sthāyi dhātus* as well as energy-linked substances to produce the units of energy required for synthetic events. Proceeding on the basis that amino-acids contribute to the brick blocks with which cellular proteins are synthesised special enzymes are seen to be required for the transference of oxidative energy through phosphorylation. It was noted in page 48 that hydolytic breakdown of proteins in cells occur entirely through cathepsins. It is seen that the preponderance of this enzyme-activity depends upon a number of factors of which the followings are important, the concentration of amino-acids, pH, temperature, oxygen-tension, source of energy, the quality and condition of co-enzymes concerned with the utilisation of energy through oxidative process, the presence or absence of toxic deleterious substances and the influence of certain hormones.

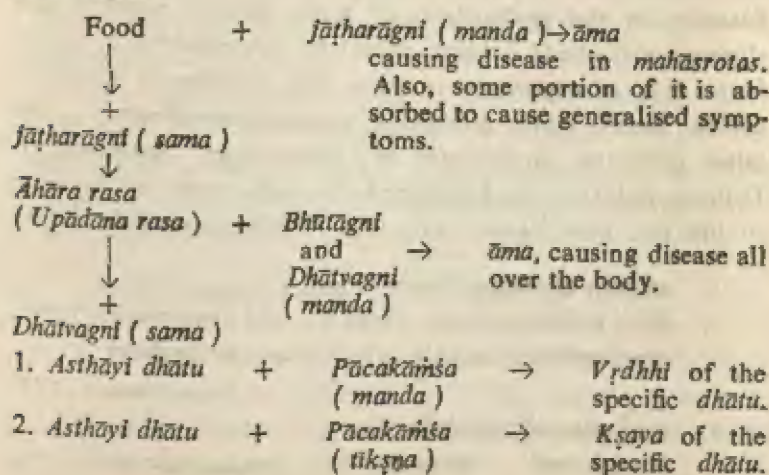
Table furnishing conditions necessary for synthetic activity or otherwise.

Normal conditions.	Abnormal conditions.
1. Normal concentration of amino-acids	1. Abnormal concentration of amino-acids.
2. Normal pH	2. Abnormal pH
3. Normal temperature	3. Abnormal temperature
4. Normal oxygen-tension	4. Abnormal oxygen-tension
5. Unimpaired source of energy	5. Impaired source of energy
6. Presence of co-enzymes of good quality and condition	6. Absence of co-enzymes or their presence in bad quality and condition
7. Absence of toxic or deleterious substances	7. Presence of toxic or deleterious substances
8. Influence of certain hormones.	8. Absence of the influence of certain hormones.

Note—Conditions entered in column two above lead to *āmadoṣa* at the intermediate and cellular metabolic levels.

Details of the processes by which factors mentioned above operate are almost completely unknown. It is, however, seen that certain broad generalisations have been made. The synthesis is an endo-thermic reaction. It can take place in cells only if energy is made available. The endo-thermic reaction mentioned above is invariably anaerobic in nature and is comparable to *bhūtāgni vyāpāra* as described in page 72-73. A function of *pācakāṁśas* in *dhātus* would generally appear to be oxidative or aerobic. The source of energy referred to above is seen to be derived from the oxidation of small organic substances, such as pyruvic acid, derived from the intermediate metabolism of glucose, fatty-acids and amino-acids. A series of enzymes are seen to be involved for the utilisation of oxygen that has been transported into cells, in step by step processes which involve small exchanges of energy. But at any stage the energy transformation can be impeded by substances which inhibit or poison the enzyme system involved in this stage.

Thus, the inhibition of poisoning of the enzyme system involved both at the intermediary and the cellular levels has a parallel to the views on *āmadoṣa* due to *dhātvaṅni* and *bhūtāgni māndya*, advanced by Ḍalhaṇa, Cakrapāṇi and Vācas-pativaidya.



ŚARĪRA BALA

Bala in ordinary parlance is strength. From a strictly technical point of view *bala* has two aspects viz., (a) the capacity to perform work or *karmaśakti*¹ (b) the capacity to resist or overcome diseases add *vyādhikṣamatva*. In general *bala* is stated to be of three kinds.²

- (a) *Sahaja* or inherited i.e. natural.
- (b) *Kāla* (Seasonal or in different ages of life)
- (c) *Yuktikṛta* or strength promoted by such measures like *rasāyana* etc.

These three different kinds of *balas* may refer both to *karmaśakti* and *vyādhikṣamatva*. The proper functioning of *antarāgni* is the *sine-qua-non*, in either case. The author has confined himself, in this paper to the study of *bala* with reference to *karma*. *Vyādhikṣamatva* is a subject by itself and needs special study. In view of paucity of time the author of this thesis has confined himself only to the *karmaśakti* aspect of *bala*.

Karma or *vyāyūmaśakti* is obviously a function related, in main, to *kapha* and *māṁsadhātu*. *Māṁsa* is one of the main *sthānas* of *prākṛta kapha*. The former is seen to endow *sthairya* (sturdiness and firmness) and *dṛḍhatā* (hardiness) to the body. Thus, *vyāyūma* is stated to promote well-formed, broad and rotund limbs, confer lightness to the body, agility and dexterity in the performance of work, healthy appetite and slimness of the body³ (this relates to the reduction of body-fat). It is of importance to note that *vyāyūma* is stated to reduce *medas*, while promoting *vibhaktaghanagātrātva*, which latter refers to an increase of *māṁsadhātu*. According to *Ḍaḥaṇa*, *bala* is to be determined by one's power or capacity to lift and bear heavy loads etc. "*bhāraharanādi-śakti-gam-*

1. कर्मशक्त्या क्षनुमीयते बलवैविध्यम् । *Caraka : Vimāna* 8 : 121.
2. त्रिविधं बलमिति सहजं कालजं युक्तिकृतं च । सहजं यच्छरीरसत्त्वयोः प्राकृतम्, कालकृतमुतुविभागजं वयःकृतं च, युक्तिकृतं पुनस्तपदाहारवेद्यायोगजम् ।

Caraka : Sutra 11 : 36.

3. लाघवं कर्मसामर्थ्यं दीप्ताग्निर्मेदसः क्षयः ।

विभक्तघनगात्रत्वं व्यायामादुपजायते ॥ *Aṅgahārdaya : Sutra* 2 : 10.

yasya"¹ and Suśruta has referred *bala* to well formed, well knit, compact and stable musculature of the body.² The term "*sarvaceṣṭāṣu apratighāta*" used by him in this connection refer to the power implicit in *bala* to overcome forces of opposition in the performance of work or action. Force that opposes actions like lifting and bearing heavy loads running against gradients, climbing a hill etc., is expressed by or reflected through the activities of *māmsa* which overcomes opposition of various kinds in the performance of work specially such as those mentioned above.

The foregoing relate to the functions of different kinds of muscles of the body and in special to the skeletal muscles. As regards other kinds of muscles, the action of skeletal muscles is supported by the *māmsapeśi* of *hṛdaya* (cardiac muscle) which by its constant contraction and relaxation enables the organ to beat and supply *rasa cum rakta* to all parts of the body, thus providing them with *indhana*; which the *māmsa peśis* of the hands, legs and other parts of the body burn to make available *śakti* to perform work. *Māmsapeśis* of *āmāśaya* (both *ūrdhva* and *adho*) known as visceral or plain muscles, provide nutrition to the body churning the food, passing it through the intestine and thus, aiding the process of digestion. It is seen that about half of physical, chemical and metabolic processes occur in *māmsapeśis* and at least 3/4th of the total metabolism is due to severe exercise. Even otherwise, much of the body heat is produced by *māmsapeśis* as compared to other *dhātus*.

Even though three grades of *bala* viz., *pravara*, *madhya* and *avara* have been mentioned by Caraka³ an objective description of them have not been mentioned in the related literature. The author in this thesis has attempted to provide objective and measurable values to these three kinds of *balas*.

1. एतत् भारहरणादिशक्तिलक्षणेन बलेन ।

Dalhana on Suśruta : Sūtra 15 : 19.

2. तत्र बलेन स्थिरोपचितमांसता सर्वचेष्टास्वप्रतिघातः स्वरवर्णप्रसादो शब्दानामाभ्यन्तराणां च करणानामात्मकार्ये प्रतिपत्तिर्भवति । *Suśruta : Sūtra 15 : 19.*

3. एवं प्रकृत्यादीनां विकृतिवर्णानां भावानां प्रवरमध्यावरविभागेन बलविशेषं विभजेत् । *Caraka : Vimāna 8 : 123.*

SECTION IV

AGNIBALA PARIKṢĀ

Prior to proceeding to the practical study of *agnibala*, it is necessary to examine the existence of a possible correlation among *agnibala*, as understood from *Jaraṇaśakti* (digestive capacity), *bala* as evidenced by *vyāyāma śakti* (capacity to perform physical work) and *mātrā* of *uṣmā* (quanta of heat) generated by the body, with all of which, *pācakāgni* is concerned. A reference to the scheme in between pages 44-45 relating to the inter relationship that exists between *pācaka-pitta* on the one hand and other *pittas*, as well as, *agnis*, on the other, will show that the former plays a vital role, (1) in the preparation of *indhana* from the food in the *āmāśaya*, (2) the processing of this *indhana* suitably in *dhātva-agni-pāka* for the utilisation by the *sthāyi dhātus* and (3) the actual burning of the *indhana* to produce the energy for work by *pācakāṁśas* present in the *sthāyi dhātus*, especially in the *māṁsadhātu*. An outcome of this process is the generation of heat. Heat, thus produced, represents the degraded aspect of energy left over after the performance of work.

Āhāra + jātharāgni → upādāna rasa (anna rasa);

Upādāna rasa + Dhātva-agni → Indhana.

Indhana + Pācakāṁśas → dhātukarma (energy) + uṣmā

(heat) + *ap* (water— H_2O).

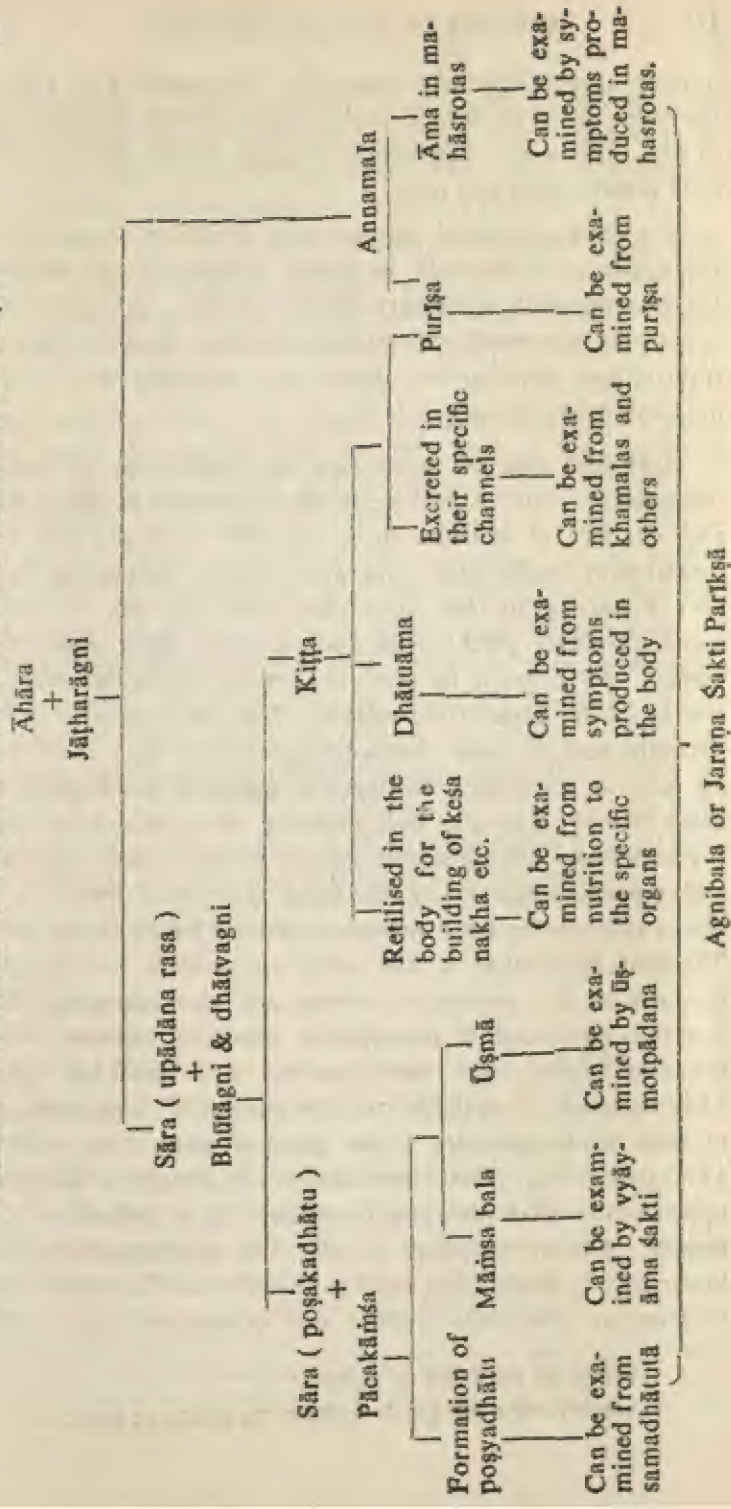
That *dehāgni* is the basis of *bala* (strength), *ūrogya* (positive health), *āyus* (longevity), *prāṇa* (élan-vital), *varṇa* (complexion), *utsāhopacaya* (increase of cheerfulness), *prabhā* (lustre), *ojas* (resistance to disease and decay), *tejas* (energy) and other *agnis* of the body is seen from the observation of Caraka.¹ According to him *agni* blazes being fed with fuel derived from *anna* and *pāna*.² *Yogaratanūkara*,

1. (a) आयुर्वर्णो बलं स्वास्थ्यमुत्साहोपचयः प्रभा ।

ओजस्तेजोऽप्ययः प्राणाश्चोक्ता देशाग्निदेतुकाः ॥ Caraka : Cikitsā 15 : 3.

(b) बलमारोग्यमायुश्च प्राणाश्चाग्नी प्रतिष्ठिताः । Caraka : Sūtra 27 : 342.

2. अन्नपानेन्यनैद्याग्निर्ज्वलति श्येति चान्यथा ॥ Ibid.



a more recent *Āyurvedic* collection, has stated that *agni* is the *mūla* (root) of *bala* in man as *retas* (semen) is the root of life. This work, has therefore, urged on the need to carefully preserve *agni* and *retas*.¹

The views expressed above, draw attention to nutrition, the capacity of the body to digest metabolise and utilise it for the production of energy. In otherwords, *agnibala parikṣā* is not only concerned with the determination of the functional state of *agni* but also its capacity to metabolise the digested food and produce energy.

It should also be noted that the production of energy measured in terms of heat is directly correlated to the quality and quantity of nutrition made available and physical and mental work performed. Age and climatic conditions have also a bearing on the functional states of *agni*. In other words, *agnibala parikṣā*, studied together with *māmsabala parikṣā* and capacity to produce *Ājasmā* is really the study of the metabolic state of the subject. This has a parallel in the determination of basal metabolic rate (B. M. R.) developed by modern medicine. This system speaks of food stuffs as being 'burnt.' This is a well chosen expression as if food is placed in an atmosphere of oxygen within a metal chamber and ignited approximately the same quantity of heat is produced as when the same amount of food is burnt in the body. The heat production is not only comparable but the end products of this process of burning are also identical. The heat thus produced is described in terms of calories. Two forms of calories have been described viz., small and large. The former has been defined as the amount of heat necessary to raise the temperature of one gram of water from 14.5° to 15.5° centigrade. The latter calorie is simply a thousand times greater than the small calorie. It is defined as the amount of heat, necessary to raise the temperature of one kilogram of water from 14.5° c to 15.5° c. Calorific value of food has also been worked out in terms of gram units.

1. अग्निमूलं बलं पुंसां रेतोमूलं तु जीवितम् ।

तस्मात्सर्वप्रयत्नेन बहिः शुक्रं च रक्षयेत् ॥ *Yogaratanādhara* : Page : 10.

Thus protein is stated to yield 4.1 calories per gram in the body, carbohydrate 4.1 calories and fat 9.3 calories per gram. The end products of the burning of food stuffs in the body yields carbon dioxide (CO_2) and water (H_2O).

As stated in the previous paragraph, heat production depends upon metabolic processes and these processes vary with subject's activities. Metabolic determinations are being carried out under well defined and rigid conditions. It has been shown that the more active the individual, the faster is his metabolic rate. Conversely this rate falls to its lowest ebb during sleep which has been described as the true basal level. Since, it may be difficult to induce sleep whenever one decides to measure metabolic state the basal level is always calculated when a subject is awake, but at perfect rest and in post-absorptive state. In actual practice, the subject is instructed to eat a light meal in the night before the determination, retire to bed to ensure about 8 hours sleep, to refrain from the excessive exercise for atleast 24 hours and to forego break-fast before the test is conducted. Metabolic tests are performed early in the morning after the subject has rested in a quite semidark room for 30 minutes. Then the estimation proceeds. The following represents the heat production in an average man under varying conditions.¹

Activities or occupation	Calories per day
Sleeping	1560
Resting but awake-sitting up	2400
Light exercise—slow walk	4080
Exhaustive exercise	15000
Tailor	2950
Stone mason	9100
Typist	2575
House maid	3840

It will be noted that the procedure and findings as described above relate to B. M. R. It does not furnish any information as regards the optimum average output of heat which a subject is capable of generating under normal conditions. Valuable as the determination of B. M. R. is, a

1. Langly & Cheraskin : The physiology of Man : Page 435, 4th Edition.

study of the optimum average heat out-put in a given individual would also appear to be equally important. The present study relates to the latter aspect.

Before proceeding to the description of actual practical study undertaken by the author in the above regard it is necessary to take into account the signs and symptoms of the normal and abnormal states of *antarāgni*, having regard to inherited tendencies, season and age as described in the *samhitās*. In fact, the findings reported in this thesis, are based on *lakṣaṇas*, relating to various conditions described above.

TABLE I.
GENETIC ASPECTS OF AGNI¹

Prakṛti or Temperament	State of agni
<i>Sama prakṛti</i>	<i>Sama</i> or normal state
<i>Vāta prakṛti</i>	<i>Viśama</i> or erratic state
<i>Pitta prakṛti</i>	<i>Tikṣṇa</i> or acute state
<i>Kapha prakṛti</i>	<i>Manda</i> or dull state

TABLE II.
STATE OF AGNI OR JARAṆAŚAKTI SEASON-WISE

Season	State of agni
<i>Griṣma</i> (June and July)	<i>Durbala</i>
<i>Varṣā</i> (August and September)	<i>Durbala</i> or weak ²
<i>Sarat</i> (October and November)	?
<i>Hemanta</i> (December and January)	<i>Tikṣṇa</i> or acute ³
<i>Śiṣira</i> (February and March)	<i>Tikṣṇa</i> or acute ⁴
<i>Vasanta</i> (April and May)	<i>Manda</i> or weak ⁵

1. पते चतुर्विधा मवन्त्यग्रवक्षतुर्विधानामेव पुरुषाणाम् । तत्र समवातपित्तश्लेष्मणां प्रकृतिस्थानां समा मवन्त्यग्रवः, वातकानां तु वाताग्निभूतेऽग्न्यधिष्ठाने विषमा मवन्त्यग्रवः, पित्तकानां तु पित्ताग्निभूते ऋग्न्यधिष्ठाने तीक्ष्णा मवन्त्यग्रवः, श्लेष्मकानां तु श्लेष्माग्निभूतेऽग्न्यधिष्ठाने मन्दा मवन्त्यग्रवः । *Caraka : Vimāna* 6 : 12.
2. आदानदुर्बले देहे पक्ता भवति दुर्बलः ।
स वर्षास्त्वनिजादीनां दूषणैर्वाभ्यते पुनः ॥ *Caraka : Sūtra* 6 : 33.
3. शीते शीतानिलस्पर्शसंरुद्धो बलिनां बली ।
पक्ता भवति हेमन्ते मावाद्रव्यगुरुक्षमः ॥ *Ibid* : 9.
4. हेमन्तशिशिरो तुल्यौ शिशिरेऽर्धं विशेषणम् । *Ibid* : 19.
5. वसन्ते विहितः श्लेष्मा दिनकृषाभिरोरितः ।
कायाग्निं बाधते रोगास्ततः प्रकुरुते बहून् ॥ *Ibid* : 22.

TABLE III.
STATE OF AGNI OR JARAṆĀŚAKTI AGE-WISE

Age	State of agni
<i>Vṛddha</i> (Old age)	<i>Manda</i> or dull ¹
<i>Yuvā</i> (Youthful)	<i>Tikṣṇa</i> or acute ²
<i>Bāla</i> (Child)	<i>Manda</i> or dull

TABLE IV.

The table below furnishes *lakṣaṇas* (signs and symptoms) of normal state of digestion.³

Signs		Symptoms	
<i>Śārīra</i> (Physical)	<i>Mānasa</i> (Mental)	<i>Śārīra</i> (Physical)	<i>Mānasa</i> (Mental)
<i>Udgāra Śud- dhi</i> (normal eructation)	<i>Utsāha</i> (Cheer- ful- ness)	Eructation of sweet taste at the beginn- ing of digestion,	<i>Viśuddha</i> (a sense of clean- liness)
<i>Vegotsarga</i> (Passing mo- tion with force)		sour taste in the middle and saline taste at the end.	<i>Viśada</i> (clear- ness of mind)
<i>Yathocitotsarga</i> (Passing mo- tion depending upon the natu- re of the diet)		Absence of <i>dāha</i> or burning sensation in the stomach or chest.	<i>Sukha</i> (plea- sure)
<i>Svasthanvṛttanu- vṛtti</i> (Conti- nuity of health)		Lightness of the body.	<i>Kāṅkṣā</i> (Desi- re for food)
		Aptitude for work.	<i>Pipāsā</i> (sen- sation of thirst).
		Appetising sensa- tion.	
		<i>Sthiratā</i> (sturdi- ness)	

1. (तस्यैवाग्निः) कदाचिन्मन्दो भवति यथा वर्षासु वार्षिक्ये च,
Cakrapāṇi on *Caraka Sūtra* 5 : 3.
2. तस्यैवाग्निः कदाचिद्वृद्धो भवति यथा—हेमन्ते यौवने च, Ibid.
3. (a) उद्गारशुद्धिरुत्साहो वेगोत्सर्गो यथोचितः ।
लघुता क्षुत्पिपासा च जीर्णाहारस्य लक्षणम् ॥
Madhavanidāna 6 : 24, *Bhāsa prakāśa* : *Tegaratnākara*.

Agni or *jaraṇasakti* has also to be considered in the light of the digestibility of food substances. Accordingly foods which are not easily digestible are to be eaten up to half of one's satisfaction.¹ As regards articles of diet which are light or easily digestible they are to be eaten up to one's full satisfaction² or slightly less than that.³ It is necessary to

(b) काष्ठा वुमुक्षा वैशद्यं लघुता स्थिरता सुखम् ।

स्वस्वद्वत्तानुवृत्तिश्च सम्भृग् जोर्णस्थलक्षणम् ॥ *Kaṣṭhāpāraṁbhita : Sūtra 24.*

(c) मधुरः पूर्वमुद्रारो मध्ये चाम्लो तथा मवेत् ।

पश्चात्तुल्यवणकश्चापि नहि दाहो भवत्यस्य ॥

लाघवं बोधते कार्यं विशुद्धं विशदं सुखम् ।

प्रगुणं कुरुते पादमूर्ध्वं वा यदि वाप्यधः ॥

भोक्तुं शक्यं भवत्यस्य रुजा (क्षुधा) चान्यो (चास्यो) पश्याम्यति ।

इत्येकिलक्षणैर्जोर्ण विषादघ्नं शरीरिणाम् ॥ *Bhelasāṁbhita : Sūtra 10.*

(d) क्षुद्देगमोक्षौ लघुता विशुद्धिर्जोर्णलक्षणम् । *Caraka : Cikitsā 30 : 303.*

1. (a) गुरूणामर्धसौहित्यं..... । *Suśruta : Sūtra 46 : 530.*

Aṣṭāṅgahṛdaya : Sūtra 8 : 2.

(b) गुरूणामल्पमादेयं..... । *Caraka : Sūtra 27 : 341.*

2. लघूनां तुप्तिरिष्यते । *Suśruta : Sūtra 46 : 530.*

3. लघूनां नाति वृत्तता । *Aṣṭāṅgahṛdaya : Sūtra 8 : 2.*

The *gurutva* and *laghutva* of *dhāra* and *auśadha dravyas*, described here is in relation to their digestibility or otherwise, which are to be judged from the point of view of *agni*. Nonetheless, it is seen from *Caraka* (*Vimāna* 1 : 22) that *dhāra* and *auśadha dravyas* have been classified as *laghu* or *guru* from two points of view viz., (1) *Svabhāva* or *prakṛti* (natural) and (2) by *samśkāra* or by suitably processing the material.

Examples of No. 1 above are *māṣa* (bengal gram) and *śukra* (pig), as regards *dhāra dravyas* which are naturally *guru* or difficult of digestion and *mudga* (green gram) and *ena* (deer) and the classical examples of *dravyas*, those are *laghu* or easily digestible. As regards No. 2, substances rendered digestible or otherwise by subjecting them to different forms of processings like (1) the addition of water as by soaking, (2) the application of heat as by cooking or frying, (3) churning, (4) emulsifying, (5) storing them for fixed duration of time, (6) by maturation, (7) by flavouring, (8) impregnation, (9) preservation, (10) and by keeping them in selected containers (*Caraka : Vimāna* 1 : 22).

note in this connection that the term '*tṛpti*' refers to feeling or sensation of satisfaction which is a highly individualised subjective criterion. The individual subject is in the final analysis the ultimate judge of it. There can be objective average standard by which *tṛpti* can be measured. In addition, a good nutrition should (1) appeal to the sense of taste, sense of smell and sight. In other words it should be tasty, possess pleasing odour and should not displease or offend the eye¹ (2) be capable of filling the stomach (3) contain all the proximate principles of nutrition. From *Āyurvedic* point of view, *dravyas* representing the six kinds of *rasas* (*madhura rasa* dominating) constitute the balanced diet.²

From the point of view of modern nutritionology, apart from substances having qualities mentioned above in 1 and 2, a balanced diet should consist of an adequate quantity of proteins with biological value, fats, carbohydrates, minerals, water and vitamins, in keeping with the age, sex, climate, season and the kind of physical or mental work which the person does. All these factors can be classified from the point of view of their *rasa* or taste.

ŚAKṚT OR STOOL IN RELATION TO AGNIBALA

An important criterion of normal digestion is as related to the nature of faeces or *śakṛt*, voided by an individual. It has been recognised by *Āyurveda* that the nature of faeces, even under normal conditions depends to a large extent upon the nature of the diet consumed.³ All things being equal, the normal faeces has a reference to the normal state of digestion. In fact, *mala parikṣā* forms part of *aṣṭasthāna parikṣā* as described in *Yogarainākara*.⁴ Notwithstanding the importance attached to the examination of *mala*, *mūtra* and other excre-

1. इष्टवर्णगन्धरसस्पर्शं विधिविहितमन्नपानं प्राणिनां प्राणसंज्ञकानां प्राणमाचक्षते कुशलाः । *Caraka : Sūtra* 27 : 3

2. पटुर्लघुमधुरप्रायः...अस्नीयात् । *Aṣṭāṅgahṛdaya : Sūtra* 8 : 36

3. उद्गारशुद्धिरुत्साहो वेगोत्संगो यथोचितम् ।

लघुता क्षुत्पिपासा च जीर्णहारस्य लक्षणम् ॥ *Madhavanidāna* 6 : 24

यथोचित उपयुक्ताहारानुरूपः । *Vijayarākṣita* on above.

4. रोगाक्रान्तशरीरस्य स्थानान्यष्टौ निरीक्षयेत् ।

नाडौ मूत्रं मलं लिङ्गा शब्दं स्पर्शं दृमाकृतीः ॥ *Yogarainākara*.

ments, direct reference to the nature of normal faeces has not been made in the available editions of *Āyurvedic* literature. However, description of pathological aspects of faeces have been furnished here and there. The author of this thesis has worked out the qualities of probable nature of normal faeces, which has formed the basis of his investigation.¹ They are furnished in the table below :

Appearance	Consti- tency	Colour	Smell	Other related data
<i>Snigdha</i>	<i>Samhata</i> (Semi solid)	Having colours except <i>śyāva pita</i> (yellow) <i>nīla</i> (blue) <i>rakta</i> (red) and <i>śveta</i> (white)	Less foul smell	No <i>sūla</i> or colicky pain. <i>Sṛṣṭa mūtra</i> or free micturition No gurgling sound of the intestine No sensation of weakness of the thigh, lumber and calf region Passage of motion in one bulk Not frothy Motion without passage of gas Having moderate temperature Free from thirst, fits, burning sensa- tion, inflammation, fever etc. Clearness of mind Sound sleep Lightness of the body Free from eructa- tion

The findings noted in the table above may have to be supplemented with additional facts of observation to make

1. संसृष्टमेभिर्दोषैस्तु न्यस्तमप्स्ववसोदति ।
पुरोषे भृशदुर्गन्धि विच्छिन्नश्यामसंक्षितम् ॥
एतान्येव तु किञ्चानि विपरीतानि यस्य तु ।
काषवं च शरीरस्य तस्य पक्वं विनिर्दिशेत् ॥

the study of normal faeces complete. In appearance the normal stool is roughly cylindrical¹ "having the consistency of butter in summer time"²; it may vary from solid to semi-solid.³ The appearance of stool depends upon the consistency as well as integrity of the passage. It depends to a large degree on the water content or stated differently on the degree to which the process of water absorption has been carried out. Certainly, other factors, such as gastro-intestinal motility and nature of diet, affect the consistency of faeces also. Small variations in diet have little or no effect on the nature of faeces. However, an exclusively vegetable diet tends to yield a larger bulk and softer consistency faeces while on a meat diet the faeces are harder and the quantity is less."⁴ Colour of the normal stool may vary from light to dark brown due to stercobilinogen "chlorophyll and other pigments."⁵ As regards smell, it is foul and offensive due to some fermentative and putriferous products—gases-like indol, skatol, ammonia, hydrogen sulphide etc.

It is necessary, in passing, to advert to the colour of the normal *purīṣa*. There is no direct reference to this aspect of the physical qualities of *purīṣa* in the available editions of *Saṃhitāgranthas*. However, it is seen from a reference made by Cakrapāṇi⁶ that in *Koṣṭhāśrita Kāmala*, the colour of the *śakṛt* resembles that of *tilaplīṣṭa* (gingili cake) or *svetavarcas*. This is stated to be due to the non-availability of *malarāṅjaka pitta* on account of obstruction to its excretion in the concerned *srotas*. Factually speaking, the condition envisaged by Cakrapāṇi resembles the description of obstructive jaundice in which due to "obstruction of the entrance of bile to the intestine faeces of the colour of *tilaplīṣṭa* or *svetavarcas* (pale coloured stool) is voided. The pigment which usually colours

1. Savills system of Clinical medicine 13th edition, page 368.
2. Machinery of the body.
3. Savills system of clinical medicine, page 368.
4. West & Todd : A text book of Biochemistry, 1955 Edition.
5. Savills system of clinical medicine.
6. श्वेतवर्चा इति कोष्ठस्य पित्तस्य मलरंजकस्य बहिर्निर्गमाद्वृद्धेन केम्पणा श्वेतवर्चा भवति । Cakrapāṇi on *Garaka* : *Cikitsā* 16.

the faeces is seen to be stercobilin, a product of oxidation of the precursor stercobilinogen which latter is derived from bilirubin a bile pigment (bilirubin is a breakdown product of R. B. C.). This pigment imparts to the normal faeces, its dark brown colour. Hence, the normal dark brown colour of the *pūṣa* has a reference to *malarāṅjaka pitta*. Thus, the study of the colour of *pūṣa* offers information relating not only to the functions of *rakta* and *pitta sthānas* like *yakṛt* and *plihā*, but also, to the *rakta* itself.

Normal and abnormal diagnostic events in different parts of koṣṭha and corresponding symptomatology.

Organ	Normal function	Abnormal function	Symptoms in abnormal function.
Urdhva- āmāsaya	Madhura-avasthā pāka	Suktapāka (Fermentation)	Gurutā or Heaviness
	Amla avasthā pāka	Apakvānna (non digestion of food)	Utkleda
	Bhinnasamghāta		Gaṇḍa & akṣikūṭa śoṭha
	Anna mārḍava karaṇa		Udgāra
Adho- āmāsaya			Avidagdha-pravartana (ūrdhvamārge)
	Amla avasthā pāka	Apakvānna (non digestion of food)	Bhrama
	Rasaśoṣaṇa	Āma formation	Tṛṭ
	Sārakīṭṭa-vibhājana		Mūrchā
		Bahupicchila (Extreme sliminess)	Oṣa
			Coṣa
			Dāha

Organ	Normal function	Abnormal function	Symptoms in abnormal function
Pakvāsāya	Drava-śoṣaṇa	Durgandhya (foul smell)	Amla-udgāra
	Mala-mūtra vibhājana	Atidrava-śoṣaṇa	Śūla
	Piṇḍikaraṇa	Alpadrava-śoṣaṇa	Ādhmāna
	Vāyu-upādāna dravyotpatti	Impaired vibhājana	Toda, Bheda etc.
	Malarūpa vāyu pravartana	Improper piṇḍikaraṇa	Mala apravṛtti.
		Formation of more vāyu (malarūpa)	Vāta apravṛtti.
		Less formation of upādāna dhāturūpa vāyu.	Stambha
			Moha
			Āṅgapīḍana
			Drava mala pravartana
			Ajāsakṛtvat mala pravartana.

Physical characteristics of normal and abnormal states of purīṣa (faeces)

Physical properties	Normal	Abnormal with cause
Consistency & shape	<ol style="list-style-type: none"> 1. Solid to semi solid 2. Cylindrical 	<ol style="list-style-type: none"> 1. Hard, dry roundish balls (ajaśakṛdvaṭ) and generally coated with mucus, known as scybalā due to defective intake of fluid or its excessive absorption by a greasy colon 2. Pencil like, due to spasm of the anal sphincter, possibly associated with anal fissure 3. Ribbon like, due to colopasm or stricture of rectum resulting from cancer, syphilis or gonorrhoea 4. Uniformly fluid, due to lesions of the small intestine like typhoid, sprue and Tuberculous or simple enteritis 5. Slimy & more fecal due to lesions of the large bowel
Colour	Light to dark brown.	<ol style="list-style-type: none"> 1. Lighter colour in diarrhoea 2. Pale colour due to (a) obstruction to the entrance of bile into the intestine as in jaundice (b) dilution of the stool as in cholera (c) Excess of unabsorbed fat (d) a milk diet 3. Clay coloured stool due to obstructive jaundice

Physical properties	Normal	Abnormal with cause
Colour (contd.)		<p>4. Pale bulky stool in stea-torrhoea, either due to defect in <i>agnyāsaya rasa srāva</i> (pancreatic secretion) or defective <i>sneha śoṣaṇa</i></p> <p>5. Tarry stool due to haemorrhage in upper part of the <i>māśarotās</i> as in duodinal ulcer. Black stool also, seen in patients taking iron, bismuth, and charcoal</p> <p>6. "Red current jelly" or strawberry ice stools are seen in intussusception</p> <p>7. Streaks of blood may be present with local lesions like <i>arśa</i></p> <p>8. Muco purulent in <i>pravāhika</i> etc.</p> <p>9. Green stool due to enteritis in infants as well as after the intake of calomel</p> <p>10. Odourless, colourless, rice water stool as in <i>adhogantūśūka</i></p> <p>11. Frothy acid yellowstool due to excessive carbohydrate fermentation</p> <p>12. Soft, brown, offensive alkaline stool of protein putrefaction</p> <p>13. Billious pea soup stool due to <i>āntrika sannipāta</i></p>

Odour	Foul due to skatol, indol, ammonia & Hydrogen sulphide etc.	1. Characteristic gangrenous smell due to severe ulceration-cancerous dysenteric & syphilitic
Presence of undigested particles of food	Should not be present	Presence of undigested food particle in excess is indicative of imperfect digestion (gastric or impestinal and unless the food has been excessive, denotes especially intestinal or pancreatic disease. In children this feature usually indicates overfeeding
Presence of mucus	Should not be present	When intimately mixed with the faeces it indicates catarrh of the small intestine. When it is present it isolated masses, it signifies the presence of catarrh of the large bowel. When long cylinders of mucus are passed, sometimes without much faeces, it indicates membranous of mucus colitis
Presence of blood	Should not be present	Blood of red colour in streaks or in quantity indicates haemorrhage from rectum or bowel. In haemorrhages from stomach and intestine, the blood undergo partly digested to give the stool a tarry colour
Presence of Pus	Should not be present	Indicates ulceration of rectum or colon which may be ulcerative colitis, dysentery, cancer, tuberculosis or of syphilitic-origin
Presence of Gall Stones	Should not be present	Passed from Gall bladder

Physical properties	Normal	Abnormal with cause
Presence of worms	Should not be present (Occasionally the presence of thread worm or Giardia is not taken as abnormality)	Some are macroscopic like round worm <i>Tenia saginata</i> , <i>Tenia solium</i> , <i>Enterobius vermicularis</i> etc. and others are microscopic like the ova of <i>Ascaris lumbricoides</i> , <i>Trichuris trichuria</i> , <i>Ankylostoma duodenale</i> , <i>oxyuris vermicularis</i> etc.

Vata	Pitta	Kapha
Tiktodgāra (Bitter eructation)	Puti udgāram (foul smelling eruc- tation)	Udgāra bāhulya (excessive eruc- tations)
Śabda pravala udgāra (Eructation with great sound)	Amla udgāra (Acid eructation)	Udgārarodha (inhibition of eruc- tation)
Saphena chardi (Frothy vomiting)	Vomiting of green, yellow, red, black, coloured material having sour and bitter in taste. Uṣṇa vamana (Hot vomitings)	Picchila vamana (slimy vomiting)
Vichīna chardi (Vomiting with splitted material)	Māmsodakābha vamana (Vomi- ting of flesh washed water)	Śleṣmayukta vamana (mucoid vomiting)
Kṛṣṇa chardi (Coffee ground vomiting.)	Dhūmra vamana (Vomiting of foamy substances)	Snigdha vamana (viscous vomi- ting)
Tanuka chardi (Thin vomiting)	Kṣārodakābha vamana	Ghana vamana (Thick vomiting)
Kasāya chardi (Astringent vomi- ting)	Hṛt dāha (Burning sensation in præcardial region)	Svādu vamana (Sweet vomiting)
Kṛcchreṇchardi (Painful vomiting)	Pipāsā (Thirst)	Śukla vamana (white vomiting)
Alpa chardi (Vomiting in less quan- tities)		Śīta vamana (Cold vomiting)
Bhukte svāsthya (A sense of ease after taking meals)		Tantumat vamana (Thready vomiting)

Vata	Pitta	Kapha
Svāsa (Dyspnoea)	Vidaha (Burning sensation in epigastric area)	Niṣṭhivana (Spitting)
Hṛdṛk (Pre-cardial pain)	Avipāka (Indigestion)	Lavaṇa praseka (saline salivation)
Āmāṣaṛk (Pain in shoulder)	Ajṛna Saraṇa (Voiding of undigested material)	Tanu praseka Thin (salivation)
Hṛdayadravaṇ (Palpitation)	Vidāha (Burning sensation)	Kapha praseka (Mucoid salivation)
Prīṣṭha śula (Colicky pain in the back)	Nabhidesa dāha (Burning sensation umbilical region)	Utkleśa (nausea)
Agnimāndya (Poor digestion)	Jirjati śūla (Colicky pain during digestion)	Gurutva (Heaviness)
Śukta pāka (Production of organic acids at the time of digestion)		Stimīta Koṣṭha (Silent gastro intestinal tract)
Kṣat (Appetite)		Āmāṣavyaṛk (Pain in stomach)
Tṛṣṇā (Thirst)		Śvāsa (Dyspnoea)
Pārsvaruk (Pain in flanks)		Aggravation after in taking meals.
Parikartikā (Sawing pain)		Agnimāndya (Indigestion.)
Āntra vikujana (Sound in the intestines)		
Viṣamāgni (Impaired Digestion)		

SYMPTOMS PERTAINED TO PAKVĀŚAYA DOŚA WISE

Vata	Pitta	Kapha
<p>Characteristics of the stool voided, are as follows :—</p> <p>Drava (Liquid) Śuśka (Dry) Tanu (Thin) Āma (Undigested) Śabdavat (Noisy) Phenavat (Frothy) Grathita (Scybulous) Picchānugata (Slimy) Kṛṣṇa (Tarry) Śyāva (Brown) Aruṇa (Reddish) Paruṣa (Rough) Vijjala (Slimy) Vipluta (which floats and spreads) Avasādi (which sinks & spreads) Āmagandhi (Having foul putrid smell) Modes/voiding are as follows :— Cīrāt (Delayed) Duḥkha (with difficulty)</p>	<p>Characteristics of the stool, voided, are as follows :—</p> <p>Nīlābha (Bluish) Pīṭhābha (Yellowish) Pūti (Putrified) Uṣmā (Hot) Drava (Liquid) Rakta (Bloody) Āma (with undigested food) Haritā (Green) Sambhinna (Broken) Pracura (in large quantities) Kṛṣṇa (Black) Atidurgandhi (very foul smelling) Others are :— Vidāha (Burning sensation) Pāka (Proctitis)</p>	<p>Bhinnamala (Broken stool) Āma saṁśrṣṭa mala (With undigested materials) Śleṣma saṁśrṣṭa mala (mucoid stool) Guru (Heavy) Picchila puriṣa (slimy stool) Sveta puriṣa (white stool) Snigdha mala (viscous stool) Tantumat puriṣa (Thready stool) Alpamala (Voiding in less quantity) Sappravāhika mala pravṛtti (Voiding with tenesmus) Abhikṣṇa mala pravṛtti (Frequent motions) Viṣṭambha (constipation) Vāṅkāṇābha (Distention of the lower abdomen) Pāyu vikṛṣṭi (sucking of anus) Nābhi vikṛṣṭi (sucking of umbilicus)</p>

Vata	Pitta	Kapha
<p>Muhurbaddha and muhurdrava (some times hard and sometimes liquid)</p> <p>Stoka (in small quantities)</p> <p>Saprvāhika (with tenesmus)</p> <p>Saruk (with pain)</p> <p>Frequent motions</p> <p>Other characteristics :—</p> <p>Viṭ sāṅga (Retention of faeces)</p> <p>Vāta sāṅga (Retention of gas)</p> <p>Āṭopa (Painful distension with sound)</p> <p>Ānāha (flatulence)</p> <p>Adhmāna (Tymphanitis)</p> <p>Viṣambha (constipation)</p> <p>Ūru-ruk</p> <p>Kukṣi ruk</p> <p>Trika ruk</p> <p>Vasti śūla</p> <p>Vāṅśaṇa ruk</p> <p>Udara vipāṭana</p> <p>Jirne prakopa</p> <p>Āhata ādhmāta</p> <p>Dṛtvat śabda (Tymphanic sound on percussion)</p>		<p>Vastivikṣīti (sucking of bladder)</p> <p>Anubandha śūla (continuity of colicky pain)</p> <p>Sancayadupa vesana (sudden voiding of large mass of retained faeces)</p>

*Other Relevant Symptoms pertaining to Gastro-Intestinal
Impirement.*

1. Kaṇṭha śoṣa (Dryness in throat)
2. Āśya śoṣa (Dryness in mouth)
3. Sarva rasagṛddhi (Desire for substances having all tastes)
4. Kaṇṭha dāha (Burning sensation in the throat)
5. Aruci (Distaste)
6. Tṛṣṇā (Thirst)
7. Āsyopdeha (coating over the mouth)
8. Āśya mādhubhya (sweet taste in the mouth)
9. Śṭhivana (spitting)
10. Vairasya (Bad taste)
11. Tṛpti (Satisfaction)
12. Kaṭu vaktratā (sensation of acrid or pungent taste in mouth)
13. Praseka (Salivation)
14. Svarabheda (Impairment in the production of sound)
15. Kṣavathu (smeezing)

Other symptoms relating to Dhātuvagni pāka.

- | | |
|-------------------|-------------------------|
| 1. Sadana | 13. Akṛśasyāpidaurbalya |
| 2. Sauhityāsahatā | 14. Striṣvahaṛṣaṇa |
| 3. Balakṣaya | 15. Ālasya |
| 4. Bhrama | 16. Kāśya |
| 5. Moha | 17. Śitajvara |
| 6. Harṣa | 18. Gātrastambha |
| 7. Tandrā | 19. Sucivedhavatvedanā |
| 8. Santoṣa | 20. Staimitya |
| 9. Nidrā | 21. Sveda |
| 10. Gaurava | 22. Jvara |
| 11. Romaharṣa | 23. Dāha |
| 12. Annadveṣa | |

AGNIBALA PARĪKṢA

PRACTICAL STUDY

MATERIAL AND METHOD OF STUDY

Material—Materials available for the study of *agnibala*, *māṁsa-bala* and *uṣmotpatti* are :

- (1) The description of normal and abnormal symptoms,

pertaining to digestion of food in the *koṣṭha*, as furnished in the available editions of *Saṁhita granthas*, commentaries thereon and as allied subjects.

(2) Normal volunteers and patients in the hospital, attached to Post Graduate Training Centre in Āyurveda.

(3) Literature relating to *balaparīkṣā*, gathered from extant āyurvedic works, as well as from allied modern medical literature.

Method—Methods of study, in so far as normal volunteers are concerned, were confined almost exclusively to *māṁsabala* and *āsmotpatti*. Observations relating to these two factors were noted by the author on the basis of his observation. Data as regards *agnibala* or *jaranāśakti* were obtained by interrogating the normal volunteers.

Agnibalaparīkṣā—Findings subjective and objective, gathered in every patient studied, were recorded in a proforma, specially prepared for the purpose (vide appendix No. 8.). Findings relating to *mala parīkṣā* were based on unaided sense observation and these were mainly confined to inspection (*rūpa*) and smell (*Gandha*). The data, provided do not include laboratory findings.

Māṁsabala parīkṣā—In so far as *māṁsabala parīkṣā* is concerned normal volunteers as well as patients were requested to run slowly a measured distance on an average not exceeding a mile, in the hostel or hospital compounds and their *ardhaśakti* was noted, having regard to the appearance of beads of perspiration on the fore-head, axillae, nose, joints, extremities and the sensation of dryness in the mouth. This is based on references made by Suśruta¹ and Vāgbhaṭa² and commentaries there on relating to the limits, uptill which *vyāyāma* or physical exercise is to be practiced.

1. व्यायामो हि सदा पथ्यो बलिनां स्निग्धभोजिनाम् ।
स च शीते वसन्ते च तेषां पथ्यतमः स्मृतः ॥
सर्वेष्वनुष्वहरहः पुष्मिरात्महितैषिभिः ।
बलस्वार्थेन कर्तव्यो व्यायामो हन्यतेऽन्यथा ॥ *Suśruta : Cikitsā* 24 : 45-46.
2. अर्धशक्त्या निषेव्यस्तु बलिभिः स्निग्धभोजिभिः ।
शीतकाले वसन्ते च मन्दमेव ततोऽन्यथा ॥ *Aṣṭāṅgahṛdaya : Sūtra* 2 : 11.

Vyāyāma according to these authorities, is to be practiced uptill the limit of half of one's strength—*ardhaśakti* by those who are strong (*balin*) and who live on viscous and fatty types of foods (*snigdhabhojin*). In addition, the permissible upper limit of strength uptill which *vyāyāma* can be performed by persons, of the type mentioned above, is confined to *Śitakāla* (*Varṣā*—August and September), *Hemanta* (December and January), *Śiśira* (February and March), and *Vasanta* (April and May) and less during the hotter seasons of the year, namely *Griṣma* (June and July) and *Sarat* (October and November). *Ardhaśakti* is seen to be a strictly individualised norm, which may vary from person to person, season to season and according to the nature of diets consumed by them. In view of these limiting considerations, the signs and symptoms of *ardhaśakti* of any individual should conform to the following criteria.

(1) According to *Suśruta* when evidence of the movement of the *sthūlika vāyu* of *hṛdaya* to *vaktra* (or mouth) is observed then *ardhaśakti* is to be deemed to have been reached.¹

(2) The appearance of beads of sweat in the axillae, brows (*lalāṭa*) nose, joints of the upper and lower extremities and dryness of mouth.²

(3) The appearance of sweat in the regions of brows, nose, joints of the limbs and axillae.³

The criteria mentioned above have, the appearance of perspiration in certain parts of the body, as a common feature. Additional points, deserving of consideration are (a) the symptoms (*lakṣaṇa*) of the movement of *hṛdīsthitā*

1. हृदिस्थानस्थितो वायुर्वेदा वक्तं प्रपद्यते ।

व्यायामं कुर्वतो जन्तोस्तद्वलार्थस्य लक्षणम् ॥ *Suśruta : Cikitsā* 24 : 47.

2. कक्षा छलाटनासासु इस्तपादादिसंधिषु ।

प्रस्वेदान्मुखशोषाच्च बलार्थं तद्विनिर्दिशेत् ॥ *Dalhana* on above.

3. छलाटदेशे नासार्या गात्रसंधिषु कक्षयोः ।

स्वेदः संजायते यस्य बलार्थं तद्विनिर्दिशेत् ॥

Note on *Aṣṭāṅga-hṛdaya* : *Sūtra* 2 : 11.

vāyu to the vaktra and (b) the dryness of the mouth. A point for consideration as regards (a) above is the identity of the *hṛdisthita vāyu* and the symptoms as may be produced in the *vaktra*. References in available literature to the five *vāyus*, draws attention to *prāṇa vāyu* which has been stated by Caraka¹ as *uraḥstha* (*hṛdaya* is an organ of *uras*). It is correlated to *kaṇṭha*, *jihvā*, *āśya*, *nāsikā* and functions such as, *ṣṭhivana* or spitting and *vaktra sañcāraṇa*² (*Suśruta*) will exclude *vyāna*³ and *udāna*⁴ which are stated to be *hṛdistha* and *uraḥstha* respectively. Since only *vaktraśoṣa* has been mentioned as a sign of *ardhaśakti* and not *śvāsa* (dyspnoea), which latter is correlated to *ativyāyama*⁵ i.e., exercise, much in excess of *ardhaśakti*, *śvāsa* as a symptom of *ardhaśakti* is to be excluded. Thus, the criterion of *ardhaśakti*, in an individual, who is strong and well nourished with viscous fatty foods, in the cooler season of the year can be summed up as follows—

(1) Appearance of beads of perspiration on brows, nose, axillae and joints of the extremities.

(2) Dryness of the mouth. These highly individualised criteria of *ardhaśakti* are for the present study explained in the following terms—“The sympathetic and parasympathetic branches of autonomic nervous system are locked up in a continuous tug of war to maintain homeostatic state and are influenced by oxygen debt and hormonal responses. The stimulation of the sweat glands of the cranial, cervical and thoracic regions by the post-ganglionic adrenergic fibres of the sympathetic system at the exact stage-point when, in the perpetual automotive tug-of-war, the equilibrium begins to crack up. As this point of the commencement of autonomic

1. स्थानं प्राणस्य मूर्धोरःकण्ठचित्रास्यनासिकाः ।

हीवनक्षत्रवृद्धरासासाहारादि कर्मे च ॥ Caraka : Cikitsā 28 : 6.

2. योर्वायु वक्त्रसंचारी स प्राणो नाम देहधृक् । Suśruta : Nidāna 1 : 13.

3. व्यानो हृदिस्थितः कृत्स्नदेहचारी महाज्वः । Aṣṭāṅgahṛdaya : Sūtra 12 : 6.

4. उदानस्य पुनः स्थानं नाभ्युरः कण्ठ एव च । Caraka : Cikitsā 28 : 7.

5. क्षयवृत्त्याश्चिच्छदिरक्तपित्तभ्रमकृमाः ।

कासशोषज्वरथासाः अतिव्यायामसंभवाः ॥ Suśruta : Cikitsā 24 : 49.

disequilibrium will always represent a particular stage of fatigue in every human being in relation to his basal, nervous and other reserves irrespective of temperament, constitution etc., and this sweat symptom in every case heralds the onset of this stage point.¹

Uṣmā Parikṣā—The production of *Uṣmā* or heat in the body is directly related to the following factors.

(a) The activities of *pācakūṁśas* in the *dhātus*, specially in the *māṁsadhātu* which represents the more active structural constituent of the body. Entering as it does into the structure of the *hṛdaya*, *dhamanī sirās*, *snāyus*, *kaṇḍarūs* and *māṁsa-peṭis* etc. which participate in all kinds of movements viz., the movement of blood from *hṛdaya* to *dhamanīs*, from *dhamanīs* to *phuphusa* and back, from *hṛdaya* throughout the whole body through *dhamanīs* and *sirās* and back all depending upon the property of *māṁsa dhātu* to contract and relax alternatively and the *māṁsa peṭis*, *snāyu*, *kaṇḍarā* and such other structures, which possess *apratighāta śakti* and perform such functions like *bhāraharaṇa gamanāgamana* and so on.

(b) The *indhana*, derived from *āhāra dravyas* under the influence of *pācakāgni* and subsequently processed by *bhūtagni* and *dhātvaṅni*.

(c) *Tejolvāṇa vāyu* of the external environment representing *vijāṭīyatejas*² (oxygen).

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1. G. B. Satyavati *et. al.* The concept of physical exercise in Āyurveda and Modern Physiology. Journal of the Government College of Indian Medicine : Mysore Vol. 1. No. 1 pages 91-92.
 2. *Nyāyabodhinī* has visualised different species of *tejas*. The combination of *vijāṭīya tejas* with a substance leading to a change in the physical and chemical characteristic of the latter, has been described as *vijāṭīya teja saṁyoga* (पाकी नाम विजातीयतेजः-संयोगः, स च नानाजातीयः). The oxygen of the air as has been shown by modern biochemistry, combines with substances to produce oxidation or burning. This can be cited as an example of *vijāṭīya tejaḥsaṁyoga*. Since, all oxidative process, which take

It is the *dahana* of *indhana* by *pācakāgni*, present in *dhātus* that is responsible for the production of *uṣmā*.

Even during rest, the burning of *indhana* and the heat generation goes on as a part of life process, although the heat, thus generated, may be less than the amount produced when a man is active. No doubt, the amount of heat produced, on account of the activities of *dhātus*, specially of *māṃsa dhātus* must be considerable but the *mātrā* of *uṣmā*, produced in normal state, represents the degraded portion of energy, conserved to the extent required to subserve the needs of normal biological activities of the body. The surplus is eliminated through various channels and in special through *sveda* under the influence of *saṃāna* which latter, it may be noted, is also, held responsible for regulating the work of

place, in the body, in course of metabolism, need oxygen, specially in the case of aerobic reactions, which produce energy and heat. Oxygen which exhibits *vilakṣaṇa* properties has to be treated as predominately *āgneya* in nature. Even otherwise, according to the *dāśanika* and *āyurvedika* schools of thought *tejas* is derived from *sāyu* and *sāyu* in its turn, from *ākāśa*. Therefore, *tejas*, is stated to combine in it, the physical properties of both *sāyu* and *ākāśa* in addition to its own. All these *dravyas* specially *sāyu* and *agni* perform *utkṛṣṭaṇa* or *brāhmagamaṇa*. Proceeding on this basis that oxygen which is gaseous or *vijāṭṭyaka* in nature is a *pañcabhūti* substance in which *sāyu* and *agni* are the more dominant factors. On account of its *āgneya* property, it is able to participate in various kinds of *pakas*.

It is also, significant to note that according to *Śarīrādhara*, *sāyu* is transported through *rasadhātu* to all other *dhātus* of the body and nourishes them.

शिराधमन्यो नाभिस्थाः सर्वे व्याप्य स्थिता तनुम् ।

पुष्पन्ति त्वनिशं वायोः संयोगात्सर्वधातुभिः ॥

Śarīrādhara : Purokhaṇḍa 6 : 47.

Oxygen fulfils the requirements of *sāyu* and it is also treated by modern bio-chemistry as nutrient substance.

pācaka in the *koṣṭha*.¹ In the final analysis *bala*, which is to be determined by *vyāyāmaśakti* has to be considered from (1) the amount of energy produced to enable the performance of *vyāyāma*, (2) the amount of heat generated in the process and (3) the capacity of the body to dissipate the surplus of heat within a reasonable time.

Thus, the method adopted by the author for the determination of *mātrā* of *ūṣmā* by prescribing *vyāyāma* to the normal volunteers and patients is meant to furnish information relating to—

- (1) The amount of *ūṣmā* produced in consequence.
- (2) The time taken by the body to develop this amount of *ūṣmā*.
- (3) The time taken by the body to regain its normal *ūṣmā*.
- (4) Increase in *nāḍīvega* (pulse rate).
- (5) The rate of *śvāsa*.

The *prakṛta* *ūṣmā* in a *svastha* is taken for the purpose of this investigation as 98.4 F, in the *Kakṣū* (by keeping thermometer for three minutes), *nāḍī* at 72 per minute and *śvāsa-prasvāsa* at 18 per minute.

*The procedure adopted for the examination of
vyāyāmaśakti and ūṣmotpatti.*

The temperature, pulse, and respiration of both volunteers and patients were taken (1) before retiring to bed in the previous night, (2) early in the following morning, while they are still in bed, after the nights rest (sleep), (3) before commencing *vyāyāma* (in the morning after visiting latrine and washing teeth), running slowly a measured distance, (4) when the signs of *ardhaśakti* appears, (5) thereafter, every 10 minutes, till the pulse, temperature and respiration returned to normal.

1. स्वेददोषान्नुवाहोनि स्रोतांसि समधिष्ठितः ।

अन्तरंगनेत्रे पाश्चर्यः समानोऽग्निबलप्रदः ॥ *Caraka Cikitsā* 28 : 8.

PROCEDURE ADOPTED FOR AGNIBALA PARIKṢĀ

The subjects choosen for *agnibala parikṣā* were patients admitted in the hospital, attached to the Post Graduate Training Centre in Āyurveda, for the treatment of various diseases. *Agnibala parikṣā* is carried out, as a routine, in every case admitted, specially in the wards of the professor of *Kāyacikitsā*. Patients suffering from active diseases or stages of diseases as the *āmāvasthā* of *jvara*, *atisāra* etc. were not taken up for this examination.

These patients were kept for three days from the date of their admission, under observation. During this time no active treatments were given to them. They were placed on a diet which was *sātmya* to them. The *mala* voided by them during the previous twenty four hours were collected, measured and studied with reference to the following points :

- (1) Time number and quantity of motions.
- (2) *Ākṛti* or appearance of the stool.
- (3) *Samhatatva* or consistency of the stool.
- (4) *Varṇa* or colour of the stool.
- (5) *Gandha* or smell of the stool.
- (6) *Jalaparikṣā* or examination by water.
- (7) Others.

TIME NUMBER AND QUANTITY OF MOTION

The time of the voiding of motion with a view to study the preponderance or otherwise of *doṣas* in the stool as described in related books was found necessary. Incidentally the quantity voided in each time was noted. In the *Āyurvedic* view, thus, *kapha* is stated to be dominant in the morning, *pitta* in the mid day and *vāta* in the evening. The *mala* voided in the morning by a *grahaṇī rogīn* (patient suffering from sprue) and such other conditions have a bearing on the *malaparikṣā* specially of the morning specimen.

A normal man is stated to void stools twice a day—morning and evening, even though his occupation and habits are factors which may influence the timing. For conditions of India, where large population are vegetarians, two motions

a day is apparently normal. This is in keeping with the *Āyurvedic* description that the passing of two motions a day indicates good health. *Prakṛti* or temperament of an individual is also seen to be considered. Thus, a person whose *prakṛti* is *paittika* is stated to pass stool for number of times,¹ where as in the case of a person belonging to *vāta prakṛti*, it is considered to be less. In an abnormal state of health as in *atisāra* and *pravāhikā*, the quantity and number of motions may be increased. In these cases *jātharāgni* is stated to be impaired with the production of *āma*.

It will be seen from the foregoing, that the *puriṣa*, its quality, quantity and number of time, it is voided has a direct bearing on the state of *koṣṭha*.

ĀKṚTI OR APPEARANCE OF THE STOOL

This relates to the form in which *śakṛt* is voided. Normal *śakṛt* should be well formed and resemble a ripe banana fruit or in other words, it must be cylindrical in shape. Such an appearance is suggestive of the integrity of the passage as well as the consistency of the stool. When the consistency of the stool is liquid we can not expect any definite shape. When the passage is obstructed by any growth or spasm of the colon, then also, there will be impairment of the shape (vide table in Page No. 190). The function *piṇḍikarāṇa* of stool has been attributed to the *pakvāsaya*. In fact the food residue along with some excretions from the large intestine get a definite cylindrical form due to the pressure of the wall of the colon during peristalsis. This peristalsis in its turn, is regulated by the condition of the *agnyādhiṣṭhāna* i.e. *grahaṇī* (small intestine).

Thus the appearance of the stool is indicative of the condition of the colon as well as *jātharāgni*.

SAMHATATVA OR CONSISTENCY

The consistency of normal stool resembles that of butter summer time i.e. semiliquid. It varies in different indivi-

1. प्रभृतसुहस्वेदमूत्रपुरीषश्च | *Caraka : Vimāna* 8 : 97.

duals according to their habitates and food, they consume. In people with irregular habits of defecation, the stool remains in the colon for a long time and more *dravaśoṣaṇa* takes place from it to make it dry. On the other hand, in *atisāra*, due to violent peristalsis absorption of water is hampered and in consequence of the motion is liquid. In some conditions, in which the mucus membrane of the intestine is inflamed, there is more exudation of fluid from blood which makes the stool liquid. Again, in some conditions where there is the presence of toxic irritant material,—physical, chemical or bacterial more water is exudated from the intestinal blood vessels to make them liquified, and evacuated as in bacillary dysentery and cholera etc.

Persons taking much vegetable leave a large quantity of undigested cellulose material to be eliminated through the bowel which makes the consistency of the stool semiliquid. But when non-vegetarian meals are taken much of it is absorbed leaving a small amount of residue which is hard. The habit of taking large quantity of water may cause liquidity of the stool.

In *vātaduṣṭi*, the consistency of stool has been described as *ṣuṣka, tanu, vijjala*, in *pitta duṣṭi* it becomes *drava* and in *kapha duṣṭi*, it becomes *tantumat*.

Thus, from the consistency of the stool, the functional states of *jāṭharāgni* as well as, *dhātvaṅni* can be studied and described.

VARUṆA OR COLOUR OF PURIṢA

Colour of normal *puriṣa* varies from light to dark brown. As mentioned previously in page 37 *varṇa* or colour of the stool is caused by *malarāṇjaka pitta* (stercobilinogen). Melanin, which is excreted from the bowel wall or synthesised from the amino-acid-tyrosin, chlorophyll which is taken with vegetables and iron, copper etc. may also influence the colour of the normal faeces.

Pathologically, conditions of the bowel, like haemorrhage of the upper gastro-intestinal tract (black colour), obstruc-

tion to the passage of bile (clay colour), inflammation of the mucus membrane of the tract as in *āntrika sannipāta jvara* or typhoid fever (*canakayuṣābha* or pea soup colour) also, influence the colour of the stool.

Vāta, vitiates the stool to produce *kṛṣṇa* (black), *śyāva* (grayish blue) or *aruṇa* (redish) colours, *pitta* produces *nīla* (blue), *pīta* (yellow), *rakta* (red) or *kṛṣṇa* (black) colours and *kapha* produces *śveta* (white) colour.

Thus, the colour of the stool is the index of local (gastro-intestinal) as well as general conditions of the body.

GANDHA OR SMELL

Smell furnishes information relating the function of *pakvāśaya*. No doubt, as stated elsewhere, the *gandha* of *śakṛt* may vary according to the diet taken. Local conditions like more putrefaction, gangrene of the colon, cancer of small or large intestine etc., may give rise to particular kinds of smells. These diseases are also, related to *āma* at the level of *dhātuvāgni* or *dhātuvāgni māndya* as it is also, called. Putrefaction, though a normal event becomes more active when there is more of undigested protein material in the colon which in its turn is correlated to *jāṭharāgni māndya*.

Thus, the smell of *pūriṣa*, has reference to some of the functions of *jāṭharāgni*.

JALAPARIKṢĀ

This test, carried out in lines, described in *samhitā granthas* by giving of small quantity of the specimen to a cup of clean tap water and the following points are noted :

(1) Whether it floats or sinks.

(2) Whether it is *avasādi*¹ (sinks and dissolves) or *vipluta*² (floats and spread). The interpretation of the observation made by *jalaparīkṣā* are on the lines furnished hereunder—

1. अवसादोति भूमौ पतितं लीनं भवति ।

Cakrapāṇi on Caraka : Cikitsā 19 : 5.

2. विप्लुतमिति प्रसरणशीलम् । *Ibid.*

(1) If the specimen floats, it is to be inferred that *āhāra pacana* and *drava śoṣaṇa* have satisfactorily taken place in the *adho-āmāśaya* and *pakvāśaya* respectively. The functional state of the *adho-āmāśaya* and *pakvāśaya* are also inferred from this *parikṣā*. An exception to this rule is whether the motion is watery or scybalous, very cold or mixed with mucus (*śleṣmā*).¹ In fact that these exceptions relate to intense *āmadoṣa* will be obvious even without *agnibala parikṣā*.

(2) *Avasāditva* or *viplutatva* are indicative of *vātātisāra*.

OTHER FACTORS

Additional informations relating to the presence of *āma* (mucus), *kṛmīs* (worms) and undigested food particles are, also to be noted. They furnish information as regards the functional states of *agnis*.

SIGNS AND SYMPTOMS RELATING TO THE STATES OF AGNI

Signs and symptoms of digestion or its impairment in the *ūrdhva āmāśaya* *adho-āmāśaya* and *pakvāśaya* are to be noted and interpreted on the basis of data, recorded in the table in pages 192-193.

In the course of this work, the author was able to examine about 38 patients for *agnibala parikṣā* and 13 cases of normal volunteers and 4 cases of patients for *vyāyāma śakti* and *ūṣmotpādana*. Table in Appendix III furnishes information relating to the cases studied so far. Graphs relating to *bala parikṣā* and *ūṣmotpādana* are also furnished in the appendix.

Details relating to the study of diseases due to the affection of different *dhātus* by *āma* formed by the impairment of *dhātvaṅni vyāpāra* are furnished in table of page 288 to 217. These relate to various kinds of metabolic disturbances, the most marked feature of which being various degrees of fatigue states.

1. मलत्यामागुरुत्वादित् पक्वा तृप्त्यवते जले ।

विनातिद्रवसंवाह शैत्यदलेष्मप्रदूषणाय ॥ Caraka : Cikitsā 15 ; 94.

DISEASES DUE TO THE AFFECTION OF DIFFERENT DHĀTUS.¹

Dhātu	Diseases
<i>Rasa</i>	<i>Āsraddhā</i> (Anoroxia), <i>Aruci</i> (Distaste), <i>Āsyavairasya</i> (Bad taste in mouth), <i>Arasajñatā</i> (Aguesia), <i>Hṛllāsa</i> (Nausea), <i>Gaurava</i> (Heaviness), <i>Tandrā</i> (Drowsiness), <i>Āṅgamarda</i> (Body-ache), <i>Jvara</i> (Fever), <i>Tamas</i> (Faintness), <i>Pāṇḍutva</i> (Pallor) <i>Srotorodha</i> (obstruction to channels) <i>Klaibya</i> (Impotency), <i>Sāda</i> (Asthenia), <i>Kṛśāṅgatā</i> (wasting of the body) <i>Agnināśa</i> (Loss of the capacity of digestion), <i>Ayathākūlavalī</i> (Premature formation of wrinkleless), <i>Ayathākōla palita</i> (premature graying of hair).
<i>Rakta</i>	<i>Kuṣṭha</i> (skin diseases), <i>Visarpa</i> (Erysipelas) <i>Pidakā</i> (Pimples), <i>Raktapitta</i> (Haemorrhage through different channels of the body), <i>Asṛgdara</i> (Menorrhagia), <i>Medhṛapūka</i> (Pudentitis), <i>Āsyapāka</i> (Stomatitis), <i>Plihā</i> (Enlargement of spleen), <i>Gulma</i> (Fantum tumous), <i>Vidrādhi</i> (Abscess), <i>Nīlikā</i> (Blue mole), <i>Kāmala</i> (Jaundice), <i>Vyaṅga</i> (Freckless), <i>Piplu</i> (Port wine marks), <i>Tīlakūlaka</i> (Black mole), <i>Dadru</i> (Ring worm), <i>Carmaḍala</i> (A type of skin disease), <i>Śvitra</i> (Leucoderma), <i>Pāmū</i> (Scabies), <i>Koṣṭha</i> (Rashes), <i>Āsramandala</i> (Red circular patchas).
<i>Māṁsa</i>	<i>Adhīmāṁsa</i> (Granuloma), <i>Arbuda</i> (Tumour), <i>Kīla</i> (Warts), <i>Galaśāluka</i> (A disease of the oropharynx), <i>Galaśuṇḍika</i> (Tonsilitis), <i>Pātīmāṁsa</i> (Gangrene), <i>Alajī</i> (A type of skin disease), <i>Gaṇḍa</i> (Goitre), <i>Gaṇḍamūla</i> (Cervical adenitis), <i>Upajihvikā</i> (Uvulitis).

1. (A) *Caraka* : *Sūtra* : 28 : 8-22.(B) *Caraka* : *Nīdāna* 4 : 47.

Dhātu	Diseases
<i>Medas</i>	<i>Keśa jaṭilibhāva</i> (Matting of hair), <i>Āsyamādhurya</i> (Sweet taste of mouth), <i>Karapādādāha</i> (Burning sensation in hands and feet), <i>Mukhaśoṣa</i> (Dryness of mouth), <i>Tāluśoṣa</i> (Dryness of palate), <i>Kaṇṭhaśoṣa</i> (Dryness of throat), <i>Pipāsā</i> (Thirst), <i>Ālasya</i> (Idleness), <i>Kāyamala</i> (Increased excrements of the body), <i>Kāyachidra-upadeha</i> (Increased discharge in the orifices of the body), <i>Aṅga-dāha</i> (Burning sensation in the body), <i>Aṅgasuptatā</i> (Numbness in the body).
<i>Asthī</i>	<i>Adhyasthī</i> (Hypertrophy of bone), <i>Adhidanta</i> (Hypertrophy of teeth), <i>Dantabheda</i> (Pain in teeth), <i>Dantaśūla</i> (Colicky pain in teeth), <i>Asthībheda</i> (Pain in bones), <i>Asthīśūla</i> (Colicky pain in bones), <i>Vivarnatā</i> (Pallor), <i>Keśaloma & smaśru-doṣa</i> (Pathological conditions of hairs), <i>Nakha-doṣa</i> (Pathological conditions of nails),
<i>Majjā</i>	<i>Parvaruk</i> (Pain in finger joints), <i>Bhrama</i> (Giddiness), <i>Murchā</i> (Fainting), <i>Tamas</i> (Faintness), <i>Sthūlamūla parvaja arumṣikā</i> (Deep seated abscess of the joints of finger),
<i>Śukra</i>	<i>Klābya</i> (Sterility), <i>Aharṣaṇa</i> (Impotency), <i>Rogiprajanana</i> (Begets diseased offspring), <i>Kliba prajanana</i> (Begets impotent offspring), <i>Alpāyu prajanana</i> (Begets short lived child), <i>Virūpa prajanana</i> (Begets deformed offspring),
<i>Snāyu, Sirā Stambha</i> (Stiffness), <i>Samkoca</i> (Contraction), and <i>Kaṇḍarū Khalli</i> (Trachioocrural newralgia), <i>Granthī</i> (Tumour), <i>Sphuraṇa</i> (Tremour), <i>Suptī</i> (Numbness).	

SYMPTOMS OF VITIATION OF DHĀTUS BY DIFFERENT DOŚAS. ¹

<i>Dhātus</i>	Symptoms due to vāta duṣṭi	Symptoms due to pittaduṣṭi	Symptoms due to kaphaduṣṭi
1. <i>Rasa</i> (<i>Tvak</i>)	<i>Rūkṣatvaka</i> (Rough skin) <i>Sphuṭṭa tvak</i> (Broken skin) <i>Supta tvak</i> (Numb- ness of skin) <i>Kṛśa</i> (Thin) <i>Kṛṣṇa</i> (Black) <i>Tudana</i> (Pain) <i>Ātanana</i> (Stretching) <i>Sarūga</i> (Redish) <i>Parvaruk</i> (Pain in finger joints) <i>Vaiṣaṇya</i> (Disco- lourisation) <i>Sphuraṇa</i> (Tremour- ing)	<i>Viśphoṭaka</i> (Ve- scicles) <i>Masurikā</i> (Me- asles)	<i>Stambha</i> (In- activity)
2. <i>Rakta</i>	<i>Saṃpāpa</i> (Feverish) <i>Tivraruk</i> (Excessive pain) <i>Vaiṣaṇya</i> (Disco- lourisation) <i>Kṛśatā</i> (Thinness) <i>Aruci</i> (Distaste) <i>Gātra Arūṅṣi</i> (Pim- les in the body) <i>Bhukta stambha</i> (In activity of the body after taking meals)	<i>Viśarpa</i> (Ery- sipelas) <i>Dāha</i> (Burning Sensation)	<i>Pāṇḍvāmaya</i> (Anaemia)
3. <i>Māṃsa</i>	<i>Gurbaṅga</i> (Heavi- ness of the body) <i>Ātyartha tudana</i> (Ex- cessive pain in the body) <i>Daṇḍāhatavat vedanā</i> (Pain like beating with a staff)	<i>Māṃsavakothana</i> (Suppuration muscles)	<i>Arvuda</i> (Tum- ours like lipo- maetic

1. Ālhaṇa or Śūtrata: uttaratantra 66 : 10.

<i>Dhātus</i>	Symptoms due to Vāta-duṣṭi	Symptoms due to pitta-duṣṭi	Symptoms due to kapha-duṣṭi
	<i>Muṣṭhihatavat-vedanā</i> (Pain like beating with fist.) <i>Atyārtha Śramita</i> (Ex- cessive exhaustion) <i>Saśūla granthi</i> (Pain- ful tumour)		
4. <i>Medas</i>	Like those of <i>mūṁsa</i> and <i>Mandaruk- granthi</i> (Tumours having less pain) <i>Avraṇagranthi</i> (Tu- mour without any ulceration)	<i>Granthi</i> (Tum- ours) <i>Sveda</i> (Swea- ting) <i>Bhṛṣatṛṣṭ</i> (Ex- cessive thirst) <i>Bhṛṣa vamaṇa</i> (Excessive vomiting)	<i>Ādracarmavan- addhābhagā- trata</i> (Feeling of being cov- ered with a wet skin) <i>Tvak gaurava</i> (Heaviness in the skin)
5. <i>Asthi</i>	<i>Asthibheda</i> (Break bone pain) <i>Parvabheda</i> (Break- bone pain in joints) <i>Sandhi śūla</i> (Pain in joints) <i>Mūṁsakṣaya</i> (Was- ting of muscle) <i>Balakṣaya</i> (Weak- ness) <i>Asvapna</i> (Sleepless- ness) <i>Santataruk</i> (Conti- nued pain) <i>Asthiśoṣa</i> (Wasting of the bone)	<i>Asthidāha</i> (Bur- ning sensation in bones) <i>Hārīdranakha</i> (Yellow nails)	<i>Sthūlatā</i> (Fatty- ness) <i>Meha</i> (Uri- nary diseases.) <i>Asthistambha</i> (?)
6. <i>Majjā</i>	Like those of <i>asthi</i> and <i>Apraśamaruk</i> (Continuous pain)	<i>Hārīdranetra</i> (Yellow eye)	<i>Śukla netra</i> (White eye)
7. <i>Śukra</i>	<i>Kṣipra śukra muñ- cana</i> (Rapid eja- culation of semen) <i>Kṣipra śukra vandhana</i> (Speedy stoppage of semen) <i>Garbha Kṣipra Muñ- cana & Bandhana.</i>	<i>Pūtiśukra</i> (Putrified se- men) <i>Pītāvabhāsa</i> <i>Śukra</i> (Yellow- ish semen)	<i>Śukra sañcaya</i> (Retention of the semen)

SYMPTOMS DESCRIBED IN MODERN MEDICINE IN DISEASES
OF GASTRO INTESTINAL TRACT. ¹

A. In diseases of *ūrdhva-āmāśaya*

1. Bad taste in mouth (*Āsya vairasya*)
2. Dryness of mouth (*Mukhaśuṣkatā*)
3. Halitosis (*Pūtīgandhi niḥśvāsa*)
4. Nausea (*Utkleṣa*)
5. Vomiting (*Chardī*)
6. Thirst (*Tṛṣṇā*)
7. Increased appetite (*Kṣut*)
8. Flatulence in the upper abdomen (*Udara ūrdhva bhāga ādhmāna*)
9. Heart burn (*Hṛt dāha*)
10. Acid eructation (*Amlodgāra*)
11. Hic cough (*Hikkā*)
12. Water brash (*Lālā praseka*)
13. Anoroxia (*Anannābhilāsa*)
14. Perverted appetite (*Kṣut vaiparitya*)
15. General malaise (*Āngamarda*)
16. A sense of ill health (*Asvāsthya*)
17. Incapacity for work (*Ālasya*)
18. Dark rim beneath the eye (*Akṣikūṭa kṛṣṇatā*)
19. Sallow or earthy complexion (*Pāṇḍutā*)
20. Emaciation (*Dhātukṣaya*)
21. Palpitation (*Hṛt dravatyā*)
22. Dyspnoea (*Śvāsakṛcchra*)
23. Pre-cardiac pain (*Hṛdaya vyathā*)
24. Syncope (*Murchā-sannyāsa*)
25. Vertigo (*Bhrama*)
26. Headache (*Śīraḥ śūla*)
27. Depression of spirit (*Dainya*)
28. Neurasthenia (*Daurbalya*)
29. Irritability of temper
30. Drowsiness (*Tandrā*)
31. Coated tongue (*Jihvā upadeha*)
32. Disturbed sleep (*Nidrā-ghāta*)

1. These symptoms are collected from different diseases of the Gastro intestinal tract from :

- A. Beaumont : Medicine
- B. Savill's system of clinical medicine
- C. Loewenberg : Medical Diagnosis 6th Edition
- D. Price Medicine

33. Urticaria (*Śītapitta*)
34. Fullness of stomach (*Udara gaurava*)
35. Paroroxia (Desire for unusual food)
36. Diarrhoea (*Atisāra*)
37. Constipation (*Viṣṭambha*)
38. Urinary change (*Mūtra parivartana*)
39. Skin change (*Tvak-Varṇa-parivartana*)

B. In diseases of adho ūmāsaya & pakvāsaya

1. Diarrhoea (*Atisāra*)
2. Tenesmus (*Pravāhana*)
3. Constipation (*Vivandha*)
4. Flatulance (*Ādhmāna*)
5. Pain (*Vedanā*)
6. Tenderness (*Sparsāsaha*)
7. Prostration (*Dainya*)
8. Vomiting (*Vamana*)
9. Collapse (*Moha-sannyāsa*)
10. Subnormal temperature (*Śīta-jvara*)
11. Wasting (*Kṣaya*)
12. Pyrexia (*Jvara*)
13. Exhaustion (*Śrama*)
14. Profuse haemorrhage (*Atiraktasrāva*)
15. Anaemia (*Pāṇḍu*)
16. Nausea (*Utkleśa*)
17. Headache (*Śiraḥśūla*)
18. Colicky pain (*Śūla*)
19. Cheeks flushed (*Gaṇḍa rāgatva*)
20. Dry tongue (*Śuṣka Jihvā*)
21. Coated tongue (*Jihvā upadeha*)
22. Thirst (*Pipāsā*)
23. Mental confusion (*Moha*)
24. Cramps (*Ākṣepa*)
25. Thready pulse (*Sūtravat nāḍī*)
26. Fatigue (*Śrama*)
27. Asthenia (*Daurbalya*)
28. Oedema of feet (*Padadeśaśoṭha*)
29. Newritis (*Vedanā*)
30. Sleeplessness (*Nidrānāśa*)
31. Urticaria (*Śītapitta*)
32. Embarrassed breathing (*Śvāsakṛchra*)

CHARACTERISTICS OF STOOL IN DIFFERENT DISEASES
DESCRIBED IN MODERN MEDICAL SCIENCE. ¹

Characteristics of the stool	Disease
Offensive	Acute catarrhal infantile diarrhoea Epidemic (Summer) infantile diarrhoea Acute ulcerative colitis
Purulent	Bacillary dysentery
Odourless	" " (in last stage)
Yellow	Acute catarrhal infantile diarrhoea
Green	" " " "
Black	Acute ulcerative colitis Gastro-duodenal ulcer and cancer
Red (Blood)	Acute ulcerative colitis Bacillary dysentery Amoebic dysentery, Malarial dysentery Kala azar dysentery, Schistosomal dysentery and Oesophago stomatic dysentery
Pale colour	Sprue
Colourless	Asiatic cholera
With mucus (<i>Ama</i> or <i>ślegma</i>)	Infantile epidemic diarrhoea Enterocolitis Acute ulcerative colitis Bacillary dysentery-gelatinous, mucus Schistosomal dysentery Cholera (flakes of columnar epithelium) Muco-colitis-Mucus passed in masses and cast of several inches long Amoebic dysentery-Brownish mucus Balantidial dysentery-Gelatinous mucus
Slimy	Acute catarrhal infantile diarrhoea, Enterocolitis
Large quantity	Sprue, Amoebic dysentery
Frothy	Sprue, Enterocolitis
Consistency liquid	Cholera (Opaque rice watery) Epidemic infantile diarrhoea, Schistosomal dysentery & Others
Consistency Semi solid	Amoebic dysentery etc.
Consistency hard	Schistosomal dysentery
Frequency more	Cholera, Bacillary dysentery and others
Morning	Sprue

1. Collected from Savill's System of Clinical Medicine, Symptoms in Diagnosis by Jonathan Compbell Meakings, 1948 Edition and Loewenberg : Medical Diagnosis, 6th Edition.

CHARACTERISTICS OF VOMIT IN DIFFERENT DISEASES
AS DESCRIBED IN MODERN MEDICAL SCIENCE.¹

Characteristics of the vomit	Disease or condition for it
A. General appearance	
1. With mucus	Chronic gastritis etc.,
2. Colouring matter	
3. Saliva	
4. Acids	
5. Foreign bodies	
6. Food (half digested)	
B. Consistency	
1. Watery	Alcoholic debauch, Chronic gastritis
2. Acidic	Hyper-chlorohydria, Acid fermentation, Peptic ulcer, Gastric crisis of Lebes, Hysteria, Migraine
3. Rice watery	Cholera
4. Semi solid	Sea sickness, Vertigo
5. Thick tenacious mucus vomiting	Acute or chronic gastritis
C. Colour	
1. Green	Patulous pylorus
2. Yellow	" "
3. Grass Green	Intestinal obstruction
4. Yellow, black, blue, red	Due to different kinds of food and drinks
5. Red	(a) Swallowing of blood as in haemorrhage from mouth i. e. lips, gums, tongue, tonsils, after or during epistaxis.

1. Collected from

(a) Savill's System of Clinical Medicine, 13th Edition.

(b) Loewenberg : Medical Diagnosis : 6th Edition.

(c) Symptoms in Diagnosis by Jonathan Combell Meakings, 6th Edition.

Characteristics of the vomit	Disease or condition for it
	(b) Blood diseases-Purpura, Haemophilia, Seurvy, Severe secondary or primary anaemia, Leukaemia, Haemolytic jaundice, Cholemia, Hodgkin's disease.
	(c) Acute fevers like Severe malaria, Typhus, Epidemic influenza, Relapsing fever, Yellow fever, Small pox, Denu, Chronic nephritis Well's disease, Portal obstruction, Atrophic cirrhosis, Yellow atrophy of liver, Passive congestion of liver, Mitral stenosis.
	(d) Vicarious menstruation
	(e) Haematemesis may also occur in Acute pancreatitis, Appendicitis, Cholecystitis, Mesenteric embolism and thrombosis.
	(f) Gestic origin, like Gastric ulcer, Duodenal ulcer, Gastric carcinoma, (Coffee ground) Miliary aneuysm and varicosis of the stomach and oesophagns, Injury to epigastric area, Poisons like Arsenic and Mercury
D. Contents	
1. Fecal vomit	Intestinal obstruction, Peritonitis, Gastro intestinal fistula
2. Pus	Pharyngeal abscess, Peritonsillar abscess, ⁴ Oesophageal abscess, Splenic or perirenal abscess
3. Phlegm (Śleṣmā)	Phlegmonous gastritis Diphtheric inflammation of the stomach

**CHARACTERISTIC OF PAIN IN DIFFERENT DISEASES OF
ABDOMEN AS DESCRIBED IN MODERN MEDICAL SCIENCE.¹**

Characteristics of the pain	Diseases or conditions for it
A. Acute pain sharp lancinating or stabbing pain	Peritonitis
B. Pressing, aching, agonising pain	Diseases of Gall bladder, Intestinal obstruction, Pancreatitis, Perforated ulcer of the stomach
C. Throbbing pain	Any inflammation or suppuration of the digestive tract
D. Colicky Gripping pain	Cholera mobus, Asiatic Cholera, Biliary colic, Renal-colic, Intestinal obstruction, Pancreatitis, Strangulated hernia, Appendicitis
E. Grinding or gnawing pain	Carinoma of the viscera
F. Dull pain	Inflammation of the mucus membrane
G. With distension	Nervous dyspepsia
H. With burning sensation	Hyper-chlorohydrria
I. Relation to food	
I. Just after food	Nervous dyspepsia, Acute and chronic gastritis Simple or malignant ulcer
II. An hour after food	Excessive acidity due to hyper-secretion or fermentation
III. Not related with food	Nervous dyspepsia and carcinoma of the stomach

1. Collected from

(a) Savill's System of Clinical Medicine

(b) Loewenberg : Medical Diagnosis, 6th Edition

(c) Symptoms in Diagnosis by Jonathan Campbell Meakings,
6th Edition

SYMPTOMS IN DIFFERENT DISEASES RELATING TO KOSHĀ
ACCORDING TO MODERN MEDICAL SCIENCE.¹

Symptoms	Diseases or conditions
A. <i>Indigestion or Avipāka</i>	Diseases of Liver, Gallbladder, Appendix, Bowel, Pancreas, Heart, Lungs, Brain, Sinuses, Eyes, Nose, Throat, Thyroid, Kidneys and other disease like Anaemia, Fevers, Septicemia, Helminthiasis, Chronic Intoxication, Diabetes, Tebes dorsalis, Neurasthenia, Hysteria and Pregnancy
B. <i>Appetite</i>	
1. Excessive	Diabetes mellitus, Hypo-pituitarism
2. Loss of appetite	Chronic Gastro-intestinal disease, Fever, Anoroxia nervosa
3. Aversion to certain kinds of foods	Achlorohydia, Hysteria, Pregnancy
C. <i>Heart burn</i>	Hyper-acidity due to acute and chronic gastritis, Gastric ulcer, Duodenal ulcer, Gastrectasis, Cholecystitis, Spastic and ulcerative colitis, Vagotonia, Achlorohydia
D. <i>Nausea</i>	
1. Psychic	Seeing revolting sights, smelling nauseating odours, listening to grave or boring tales
2. Reflex.	Eye strain, Diseases of the middle ear, Migraine, Sea sickness, Car sickness, Intestinal worms, Ovarian diseases, Pregnancy
3. Nervous cause	Hysteria, Neurasthenia, Psychoasthenia

1. Collected from

(a) Savill's System of Clinical Medicine, 13th Edition

(b) Loewenberg : Medical Diagnosis, 6th Edition

(c) Jonathan Campbell Meakings : Symptoms in Diagnosis, 6th Edition

Symptoms	Diseases or conditions
4. Gasto intestinal Causes	Cholecystitis, Duodenitis, Achlorhydria Chronic gastritis, Acute gastritis, Carcinoma of the stomach, Pyloric obstruction, Gastrectasis, Cirrhosis of liver, Colitis, Constipation, Toxic gastritis
5. Toxic causes	Eating greasy or spoiled food, over eating, Uremia, Pregnancy, Hyper-digitalisation Other diseases are Pellagra Diabetes mellitus Acidosis, Acute Pancreatitis, Acute nephritis, Pulmonary tuberculosis, Exophthalmic goiter, Addison's disease. Chronic myocarditis, Mitral stenosis
E. Eructation (Water brash)	Oesophagitis, Stricture or obstruction of the oesophagus, oesophageal, diverticulum Gastric ulcer, Gastric dilatation
F. Vomiting (Acute)	Sea sickness, car sickness, after general anaesthetics, certain types of food ingestions, emetic drugs like apo-morphin, ipecac, Copper sulphate, Zinc sulphate, Antimony etc. in psychic shock, Fright, undue Excitement, Anxiety, Disgust
	Acute appendicitis, Acute intestinal obstruction, Incarcerated hernia, Acute peritonitis, Acute gastritis, Acute Gastro-enteritis, Migraine, Cholecystitis, Cholelithiasis, Nephrolithiasis, Acute Bright's disease, Uremia, Acute alcoholism, Hyperdigitalisation and after administration of Morphine
(Chronic)	Fracture of skull, Cerebral embolism, Sinus thrombosis, Yellow fever, Acute yellow atrophy of liver and Acute hepatic degeneration 1. Stomach. Carcinoma, Ulcer, Achylia gastrica, Pyloric stenosis of infancy, Gastrectasis, Chronic gastritis, Pylorospasm, Ulceration of the oesophagus, Hourglass contraction of the stomach, Syphilis or Tuberculosis of the stomach

Symptoms	Diseases or conditions
G. Diarrhoea Acute.	II. <i>Intestines</i> . Chronic intestinal obstruction, Carcinoma of the colon, Carcinoma of the small intestine, Dysentery, Ulcerative colitis, Ulceration of the intestine, Paralytic ileus, Diverticulitis, Regional ilitis, Intestinal worms, Pancreatitis, Pancreatic cyst, Adenoma of the islands of Langerhans
	III. <i>Liver</i> . Cirrhosis of the liver, Amyloid liver, Bant's disease, Carcinoma of the liver, Carcinoma of the bile duct, Carcinoma of the Gallbladder, Abscess of the liver and Passive congestion of the liver
	(B) <i>Diseases of Nervous system</i>
	Cerebral tumour, Cerebral abscess, Hydrocephalus, Cerebral haemorrhage, Cerebral syphilis, Loco Motor, ataxia, Pachy meningitis, Pituitary cachexia, Hysteria, Psychosthenia, Nuras-thenia
	(C) Diseases of endocrine system, Exopthalmic goitre, Myxedema, Addison's disease
	(D) Diseases of the cardio-vascular system Congestive heart failure, Chronic myocarditis, Coronary thrombosis, Aneurysm of the abdominal aorta, Mitral stenosis
	(E) Diseases of the haemopoetic system :— Purpura, Primary and severe secondary anaemia, Sick cell anaemia, Leukaemia
	(F) Reflex causes :—Eye strain, Pertusis, Angioneurotic oedema, Allergic reactions, Prostatitis
	(G) Toxic causes—Chronic glomerular nephritis, Nephro sclerosis, Chronic nephrosis, Pregnancy, Chronic alcoholism, Vitamin deficiencies
	Food and drug poisoning. Entero-colitis, Iilitis, Cholera morbus, Asiatic cholera, Bacillary dysentery, Acute amoebic dysentery, Sprue, Pallegra, Typhoid fever, Influenza, Mesenteric thrombosis, Vit 'B' and 'D' deficiencies

Symptoms	Diseases or conditions
	Chronic entero-colitis, Ulcerative colitis, Mucus-colitis Tuberculus enteritis, Sprue, Coeliac disease, Carcinoma of the pancreas, Chronic amoebic dysentery, Nervous diarrhoea and some other parasitic infections
H. Constipation.	<p>Bad stool habit, improper diet, Insufficient liquid intake, Sedentary habit</p> <p>In diseases like Intestinal obstruction, Strangulated hernia, Neoplasms, Strictures, Mucus colitis, Paralytic, ileitis, Fecal impaction</p> <p>Lead poisoning, Opium poisoning, Visceroptosis, Haemorrhoids, Fissures in anus, Fistulae in anus</p> <p>Some other gastro-intestinal, hepatic gall bladder and nervous diseases and Anaemia</p>
I. Abdominal pain (Generalised)	<p>Generalised peritonitis, Acute haemorrhagic pancreatitis, Ruptured gastric ulcer, Mesenteric thrombosis, Acute gastro enteritis, Acute enterocolitis, Acute intestinal obstruction, Tumour of large intestine, Tumours of small intestinal food poisoning, ulcerative colitis, Mucus colitis, spastic colitis, Amoebic dysentery, Bacillary dysentery, Lead, Arsenic, Mercury, and other metal poisoning, Tebes dorsalis, Addison's disease, Exophthalmic goitre, Asiatic cholera, Achylia gastrica, Abdominal aneurysm, Tuberculosis, Peritonitis, Torsion of an ovarian cyst, Abdominal neoplasm</p> <p>Occasionally in Appendicitis, Regional ileitis, Retro peritoneal malignancy, Chronic constipation, Allergic dyspepsia, Intestinal worms</p>

Symptoms	Diseases or conditions
II. Epigastric Pain	Hyper acidity, Gastric ulcer, Duodenal ulcer, Acute or chronic gastritis, perforated gastric or duodenal ulcer, Acute haemorrhagic pancreatitis, Chronic pancreatitis, Cholecystitis, Cholelithiasis, Nephrolithiasis, Abdominal angina, Tabes dorsalis, Omental hernia, Abdominal aneurysm, Retroperitoneal malignancy, Diaphragmatic hernia
III. Pain in the right hypochondrium	Cholelithiasis, Cholecystitis, Subphrenic abscess, Diseases of liver such as Carcinoma, Cyst, Abscess, Cirrhosis, and Active or Passive congestion, Carcinoma of the hepatic flexures
IV. Pain in the left hypochondrium	Diaphragmatic hernia, Splenic infarction, Splenomegally, Rupture of spleen, obstruction of the bowel, Carcinoma of the splenic flexure, Mucus colitis, Spastic colon Referred pain by Cholecystitis and Cholelithiasis
V. Pain in the right loin	Nephrolithiasis, Hydronephrosis, Pyonephrosis, Pyelitis, Nephritis, Tuberculous-Kidney, Polycystic kidney Abscess and cyst of kidney and adrenals
VI. Pain in the left loin	As in right side
VII. Pain in iliac region.	Acute appendicitis, Acute salpingitis, Ruptured ectopic gestation, Ovarian cyst, Inguinal hernia, Acute diverticulitis, Acute pyelitis, Psoas abscess, Ulcerative colitis, Tuberculosis of caecum, Cacinoma of the colon, Fecal impaction, Regional ileitis, Typhoid fever
VIII. Pain in the hypogastric region	Retention of urine, Disease of ureter, bladder, uterus, Pelvic cellulitis, Constipation, Tumour and Cancer etc.
IX. Pain in rectum	Ischeo-rectal abscess, Haemorrhoids, fissures, Ulceration, Stenosis, Carcinoma polyp

Symptoms	Diseases or conditions
J. <i>Bad Taste in Mouth</i> (<i>Āśya vairasya</i>)	Gastric disorders
K. <i>Dryness of lips and mouth</i> (<i>Mukha Oṣṭha śoṣa</i>)	
L. <i>Halitosis</i> (<i>Putigandhi Svāsa</i>)	
M. <i>Thirst</i>	Dyspepsia, Acute dilatation of the stomach, Inflammation of Stomach, Vomiting
N. <i>Flatulence</i>	Chronic gastritis, Gall bladder dyspepsia, Nervous individuals
I. Gastric	
II. Intestinal	Fermentation of starch and sugar, constipation, Diarrhoea, Paralytic Ilius, Coeliac disease Sprue
O. <i>Hic cough</i>	1. Reflex stimuli of phrenic nerve by gastric or colonic flatulence or by irritant food II. Irritation of the peritonium—local or general—Typhoid III. Nervous hysteria
P. <i>Water brash</i> (<i>Praseka</i>)	Irritation of stomach, Dyspepsia, Peptic ulcer
Q. <i>Anoroxia</i> (<i>Anannābhilāsa</i>)	
R. <i>Tenesmus</i> (<i>Pravāhaṇa</i>)	I. Various conditions of the anus like Pruritis, Eczema, Fissure or Piles II. Rectal conditions like Carcinoma, Proctitis, Stricture etc. III. Hysterical and Nervous subjects IV. Other causes of diarrhoea as mentioned above.

DISCUSSION

The concept of *agni* is seen to be based on earlier *Sāṅkhya* and *Nyāya-vaiśeṣika* concept of *tejas*. *Āyurveda*, while benefiting by these contributions, is seen to have modified them in the context of the process of life. The difference between *dārśanika* and *āyurvedic* views, in this regard is comparable to the science of physics (including Chemistry) in its pure aspect and bio-chemistry which is an applied aspect of the former science. But in general, the basic concept of *agni* is the same for both the pure and applied schools of sciences. The science of *Āyurveda*, which is basically the science of life or biology has seen in digestive and metabolic processes the manifestation of *tejas* or *agni*. Various biological substances present in the body which perform actions similar to *agni* have been classed under the heading or implicit in the concept of *pitta*.

In addition to the five kinds of *pittas* which have special functions to perform, *Āyurveda* has described seven species of *dhātuvāgnis* and five species of *bhūtāgnis*. The former are seen to relate to substances, which are necessary for what is described as *dhātuvāgni vyūpāra*, and the latter to the principle present in each molecule of organic substances which are utilised for the digestion of the molecule itself in anaerobic type of reactions. Substances included under *dhātuvāgni* are seen to be represented by group specific and reaction specific enzymes. The latter was shown to represent the oxygen present in the structure of the molecule itself. This oxygen has been designated as *sajātīya tejas*, whereas molecular oxygen derived from the atmospheric air required for aerobic reactions as *vijātīya tejas* the two terms being drawn from *Nyāyabodhinī* commentary on Annambhaṭṭa's *Tarkasaṃgraha*. Of the five *pittas*, described in *Āyurveda*, the importance of *pācaka pitta* was brought out and its correlation to tissue metabolism was shown inviting, incidentally, attention to the role of cathepsins in anaerobic and catabolic processes. *Jātharāgnīpāka* corresponding to gastro-intestinal digestion, in all its different aspects was discussed at some length. The process of digestion, as described in *Saṃhitā granthas*

was critically studied and reoriented and brought uptodate indicating the digestive events that take place in different parts of the *koṣṭha* or gastro-intestinal tract. The concept of *vipāka* was also examined at some length in this connection. The implication of digestive events, that occur in the *pakvāśaya*, including the part, it plays as *vātasthāna* was sought to be explained in the light of data contributed by modern researches in biochemistry and micro-biology.

Likewise *dhātuvagnipāka*, corresponding to intermediary metabolism was explained drawing material therefor, from the available original *Āyurvedic* classics and important commentaries thereon. The nature of intermediary metabolites *prasāda* or *poṣaka dhātus* and *kitta* or waste products and their utilisation or disposal as the case may be was discussed and reoriented. The mode of production of *dehā-ūṣmā* or body heat was examined, vis-a-vis, *pācakāṁśas*, *viñātiya tejas*, and *indhana* represented by oxygen and nutrition respectively. (1) *Jāṭharāgni* and *dhātuvagni vyāpāra*, in view of *agnibala* and (2) *vyāyāmaśakti* and *ūṣmotpatti* in view of *māṁśabala nirṇaya* were studied in a number of normal subjects as well as patients admitted to the Hospital attached to the Post Graduate Training Centre, Jamnagar. The data gathered from (1) and (2) above were then studied together with a view to correlate *agnibala*, *māṁśabala* and *ūṣmotpatti*. It has to be noted here that *bala nirṇaya* referred to above does not cover *vyādhi kṣamatva*, as this aspect of *bala* forms a subject by itself, it has not been attempted in this thesis.

Bala-vyāyāmaśakti and production of Ūṣmā

The data collected from the study of *vyāyāmaśakti* in normal subjects and patients in wards, led to the following highly suggestive conclusions.

(1) In six normal volunteers of age ranging from 22 to 25 years, it was seen that the time of reaching *ardhaśakti* ranged between 15 to 20 minutes having regard to the appearance of sweat on the forehead, axillae and joints of upper and lower limbs and corresponding temperature, pulse, and respiration rates-an average of 16.5 minutes. The time

taken for the temperature, pulse and respiration to reach back to normal ranged between 30 to 45 minutes, the average being 41.5 minutes. The ratio of the time taken to reach *ardhaśakti*, vis-a-vis an increase in the temperature, pulse and respiratory rates and their return to normal is seen to be on an average 2 : 5.

(2) In three normal volunteers of age ranging between 22 and 25 years the time of reaching *ardhaśakti* ranged between 7 to 10 minutes, having regard to the appearance of sweat in the fore-head, axillae and joints of limbs and the corresponding increase in their pulse, temperature and respiratory rates on an average of 8 minutes. The time taken for the temperature, pulse and respiration to return to normal ranged between 35 to 105 minutes—the average being 65 minutes. The ratio of the time taken to reach *ardhaśakti* and to return to normal is seen to be on an average 1 : 4.

(3) In another group of three normal volunteers of age ranging between 22 and 25 years the time of reaching *ardhaśakti* was 5 minutes in each case having regard to the appearance of sweat in fore-head, axillae and joints of limbs, corresponding to an increase in pulse, temperature and respiration rates. The time taken for the temperature, pulse and respiration to return back to normal ranged between 130 to 150 minutes, the average being 138 minutes. The ratio of the time taken to reach *ardhaśakti* and return to normal is seen to be on an average 1 : 27.

Figures presented above, though obtained from a small number of normal volunteers were still sufficient to provide hypothetical criteria for the determination of *pravara*, *madhya* and *avara* types of *bala* which can be summed up thus :

(i) *Pravara bala*—The return of temperature, pulse and respiratory rates to normal should be about $2\frac{1}{2}$ times, the time taken by the subject to reach his *ardhaśakti* (corresponding temperature pulse and respiratory rates)

(ii) *Madhyabala*—The return of temperature, pulse and respiratory rates to normal should be about four times the time taken by the subject to reach his *ardhaśakti* (corresponding temperature, pulse and respiratory rates)

(iii) *Avarabala*—The return of temperature, pulse and respiratory rates to normal is about 27 times the time taken by the subject to reach his *ardhaśakti* (corresponding temperature, pulse and respiratory rates).

Note—It is of course understood that these figures relate to *snigdhabhojins* who are exercised in the morning of late *Śiśira*. These figures in *rūkṣa bhojins* may possibly vary even in *śitakāla* and more so in *uṣṇakāla*. This hypothetical formula of three grades of *balas* can be studied in a much larger number of normal persons belonging to different age groups.

This study was extended in the first instance to three patients admitted to the Hospital attached to Post Graduate Training Centre in Āyurveda, Jamnagar. It elicited the data as shown in the Table at page 176.

The *bala* of these three patients, judged from the point of view of *pravara bala* may have to be treated as *avara bala*. As regards their *agnibala*, it was found that in all the three cases, it was *manda*.

Summing up—Proceeding on the basis of the material available in the Āyurvedic classics, it was possible to provide a fairly dependable clinical method for determining *agnibala* by *jarapaśakti*, and *māṃsa bala* and *ūṣmotpatti* from the point of view of *vyāyāma śakti*. As regards the former, normal and abnormal states of functioning of *agni* in different parts of the *mahāsrotas* and clinical symptoms relating to them have been furnished. As regards the latter, note has been taken of the *hṛdaya*, which is the *mūla* of *rasavaha* and *prāṇavaha srotas* and the *mūla dhamanīs srotas*, *māṃsa*, *sirā*, *kaṇḍarū*, all of which have *māṃsa* as a common structural factor. In judging *śārīra bala*, as reflected by *pravara* type of *vyāyāmaśakti* which signifies the integrity of the entire organism, *hṛdaya* is correlated to *phuphusa* through *rasa-rakta*, and to *māṃsa dhātu* every where in the body through *sirās* (vessels) which in their turn, also contain *māṃsa dhātu* in their structure. The *rasa* and *rakta* transporting *poṣaka-dravyas* including *vāyu* to the *sthāyī māṃsa dhātus*, among others, the *pācakāmśa* in the *sthāyī dhātu* representing in-

trinsic *agni* of this *dhātu*, *śajātīya tejas amśas* present in the *poṣaka dhātus*, combining with *viśātīya tejas* transported by *rasa* and *rakta* causes *pāka*, *dahana* and *tapana*, resulting in the production of *karmasakti* (energy) on the one hand, and *kiṣṭa* (waste products like CO_2 , H_2O etc.) on the other. At the level of *ardhaśakti*, the production of *kiṣṭamśa* having reached a point where the available *viśātīya tejas* is inadequate to digest them, leads to increased functioning of *hṛdaya* and *prāṇavaha śrotas* as reflected in an increased rate of *hṛt-spandana* (heart rate) *ucchvāsa-nīhśvāsa* (respiration) and *uṣmotpādana* (temperature). These lastly mentioned factors, at the level of *ardhaśakti* and the corresponding time taken by any individual to reach this point, studied together with the rapidity with which these three factors return to their *prākṛta* level, constitute a fairly reliable index for assessing the *māṁsa bala* and *agnibala* in any given individual.

Conclusion—The author does not claim to have covered or exhausted the entire subject, considering the time and facilities he could command. None the less, he believes to have initiated a new mode of approach to some of the basic aspects of *Āyurveda* which may have to be continued in many directions not only by the future post graduates, but also by other workers interested in this subject, elsewhere in the country.



Name	Age	Disease	Duration of disease	Time taken to reach ardhhaśakti	Time taken to come to normal	Ratio
1. Ranchoda	21 yrs	Atatvabhiniveśa	2 months	3½ minutes	50 minutes	1:14
2. Babu Samji	14 yrs	Kṣaudraśvāsa	1 year	9 minutes	135 minutes	1:15
3. Premji Hamid	17 yrs	Kṣaudraśvāsa	2 months	15 minutes	130 minutes	1:8

APPENDIX-I

Analysis of symptoms of diseases of Koṣṭha—classified in relation to different functional parts of mahāsrotas.

Disease	Symptoms relating to <i>Urdhya-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Grahāṇī</i> (Sense of ease after taking meals)	<i>Bhukte Svāsthya</i> (A sense of ease after taking meals)	<i>Hṛt dāha +</i> (Burning sensation in the praecardium)	<i>Hṛllāsa</i> (Nausea)	*Due to <i>Kapha vṛddhi</i>	<i>Agnimāndya</i> (Impaired digestion)	<i>Ajirṇa śarāṇa</i> (Voiding of undigested food in the motion)	<i>Duḥkha pacana</i> (Retarded digestion)		<i>Uru ruk</i> (Pain-thighs)	<i>Nilābha śarāṇa</i> (Voiding blueish stool)	<i>Bhīṇa mala</i> (Broken faeces)		<i>Kapṭhaśoṣa</i> (Dryness in the throat)
<i>Śvāsa +</i> (Dyspnoea)	<i>Pūṭi ud ÷ gāra-</i> (foul smelling eructation)	<i>Duṣṭa Udgāra</i> (Foul smelling eructation)		†Due to upward pressure of the distended stomach	<i>Śukta pāka</i> (Production of Organic acids due to fermentation)				<i>Vaṅkṣaṇa ruk</i> (Pain-groins)	<i>Pitūbha śarāṇa</i> (Voiding yellowish stool)	<i>Āmāsaṁśṛṣṭa</i> (Mixed with undigested material)		<i>Āśyaśoṣa</i> (Dryness in mouth)
<i>Tiktodgāra</i> (Eructation having bitter-taste)	<i>Amla ud-gāra</i> (Acid-eructation)	<i>Madhura Udgāra</i> (Sweet eructation)		+ Referred burning sensation ÷ Due to putrifaction	<i>Kṣut</i> (Appetite)	<i>Tṛṣṇā</i> (Thirst)			<i>Ādhmāna</i> (Flatulence) at the end of digestion	<i>Pūṭimāla śarāṇa</i> (Voiding of putrified stool)	<i>Śleṣma saṁśṛṣṭa</i> (Mixed with mucus)		<i>Sarvarasa gṛdhhi</i> (Desire for substances having all rasas or tastes)
					<i>Pārśvaruk</i> (Pain in Flanks)				<i>Cirāt mala śarāṇa</i> (Delayed voiding)		<i>Soṇcayāt upaveśanam</i> (Voiding of large collected mass of stool)		<i>Kapṭhadāha</i> (Burning sensation in the throat)
					<i>Parikartikā</i> (Sawing pain)				<i>Duḥkha śarāṇa</i> (Voiding faeces with pain)		<i>Vikṣambha</i> (Constipation)		<i>Aruci</i> (Distaste)
									<i>Drava mala</i> (voiding liquid motion)				<i>Tṛt</i> (Thirst)
									<i>Śuṣka mala</i> (Dry Stool)				<i>Āsyopadeha</i> (Coating in the mouth)
									<i>Tanumala</i> (Loose motion)				<i>Āśya mādhyura</i> (A sensation of sweet taste in the mouth)
									<i>Āma mala</i> (Undigested stool)				<i>Śṭhivana</i> (Spitting of saliva)
									<i>Śabdavat mala</i> (Noisy motion)				<i>Vairasya</i> (Bad-taste)
									<i>Phenavat mala</i> (Frothy stool)				
									<i>Muhur-badha</i> <i>Muhur-drava</i> (Sometimes constipation and sometimes loose motion)				

Disease	Symptoms relating to <i>Urdhya-amāśaya</i>				Symptoms relating to <i>Adha-amāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	Vāta	Pitta	Kapha	Remarks	Vāta	Pitta	Kapha	Remarks	Vāta	Pitta	Kapha	Remarks	
<i>Udara</i>		<i>Dāha</i> (Burning sensation)	<i>Utkleśa</i> (Nausea) <i>Śvāsa*</i> (Dyspnoea) *Referred		<i>Avipāka</i> (Indigestion)	<i>Dāha</i> (Burning Sensation)	<i>Avipāka</i> (Indigestion)		<i>Udara vipātana</i> (Sensation of splitting of the abdomen) <i>Kukṣi śūla</i> (Colicky pain in the lower abdomen) <i>Udāvarta</i> (Tymphanitis) <i>Adhogurutva</i> (Heaviness in the lower abdomen) <i>Vāta-saṅga</i> (Retention of gases) <i>Varcasaṅga</i> (Retention of stool) <i>Āhata-ādhmāta dṛtivat-śabda</i> (Tymphanic note on percussion)	<i>Atisāra</i> (Diarrhoea) <i>Dāha</i> (burning sensation) <i>Haritavarca</i> (Green stool) <i>Hāridra varca</i> (Yellow stool)	<i>Śuklavarca</i> (White stool)		<i>Arocaka</i> (Distaste) <i>Kaṭukāśyatva</i> (Sensation of acrid taste in the mouth)
<i>Arśa</i>	<i>Udgāra</i> (Eructation) <i>Śvāsa*</i> (Dyspnoea) <i>Hṛdgraha*</i> (Embarrassment of the chest) <i>Hṛdayadrava</i> (Palpitation) *Referred	—	<i>Hṛllāsa</i> (Nausea) <i>Chardi</i> (Emesis) <i>Praseka</i> (Salivation) <i>Niṣthivikā</i> (Spitting)	—	<i>Agni-Vaiṣamya</i> (Impaired digestion) <i>Antrakūjana</i> (Noise in intestine)	—	<i>Agnimāndya</i> (Poor digestion)	—	<i>Kukṣyathā</i> (Pain in lower abdomen) <i>Vankṣaṇa vyathā</i> (Pain in groin) <i>Uravyathā</i> (Pain-things) <i>Viṣṭambha</i> (Blocking of faeces) <i>Grathitamala</i> (Seybala) <i>Stokamala</i> (Scanty faeces)	<i>Dāha</i> (Burning sensation) <i>Pāka</i> (Proctitis) <i>Uṣmamala</i> (Hot stool) <i>Dravamala</i> (Liquid stool) <i>Nilamala</i> (Blue stool) <i>Pita mala</i> (Yellow stool) <i>Rakta mala</i> (Red stool)	<i>Vankṣaṇa ānāha</i> (Distension of the lower abdomen) <i>Pāyuvikarṣi</i> (Sucking of the anus) <i>Nābhivikarṣi</i> (Sucking of the Umblicus) <i>Vasthivikarṣi</i> (Sucking of the bladder) <i>Vasābhapuriṣa</i> (Fat like stool)	—	<i>Arocaka</i> (Dis-taste) <i>Kṣavathu</i> (Sneezing) <i>Svaropaghāta</i> (Impairment of Voice) <i>Āsyamādhurya</i> (Sensation of sweet taste in mouth.

Disease	Symptoms relating to <i>Ūrdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Śula</i>	<i>Hṛtśūla*</i> (Colicky pain in Pre-cardium) <i>Pārśvaśūla</i> (Colicky pain in flanks) <i>Prsthāśūla</i> (Colicky pain in backside) <i>Śvāsakṛcch-ara</i> (Dyspnoea) *Referred pain	—	<i>Hṛllāsa</i> (Nausea) <i>Praseka</i> (Salivation) <i>Āmāśayaruk</i> (Pain in stomach) <i>Stimīta koṣṭha</i> (Low peristaltic movement in the gastrointestinal tract) <i>Bhukte ruk</i> (Pain after digestion)	—	—	<i>Nābhideśa dāha</i> (Burning sensation in umbilical region) <i>Vidāhakāla Kopano</i> (Aggravates during digestion)	—	—	<i>Saśabdāmāla</i> (Voiding of stools with noise) <i>Sappravāhikā māla</i> (Passage with tenesmus) <i>Saruk Upaveśana</i> (Voiding with pain) <i>Saphena upveśana</i> (Voiding frothy stool) <i>Picchānugata</i> (With slimy material) <i>Kṛṣṇa vit</i> (Tarry stool) <i>Śyavārūṇa-Paruṣa-Purīṣa</i> <i>Trikaśūla</i> (Colicky pain in the lumbar region) <i>Bastiśūla</i> (Colicky pain in the bladder) <i>Jirṇe kopah</i> (Aggravation after digestion) <i>Vit stambha</i> (retention of faeces) <i>Vātastambha</i> (Retention of gases) <i>Vāta purīṣa kṛcchra</i> (Painful voiding of stool and Gas)	<i>Āmāmāla</i> (Stool with undigested material) <i>Haritamāla</i> (Green stool) <i>Sambhinnamāla</i> (Broken stool) <i>Pracura vit</i> (Voiding large quantities)	<i>Sakaphapurīṣa</i> (Phlegmagenous stool) <i>Sappravāhikā purīṣa</i> (Motion with tenesmus) <i>Gurupurīṣa</i> (Heavy stool) <i>Picchīla</i> (Slimy) <i>śveta</i> (White)	—	<i>Aruci</i> (Distaste)

Disease	Symptoms relating to <i>Urdhva-āmāśaya</i>				Symptoms relating to <i>Adha-āmāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Parīṇāma Śūla</i>	—	—	<i>Chardi</i> (Emesis) <i>Hṛllāsa</i> (Nausea)	—	—	<i>Dāha</i> (Burning sensation)	—	—	<i>Ādhmāna</i> (Flatulence) <i>Ānāha</i> (Painful distension of abdomen with sound) <i>Vātabandha</i> (Retension of faeces)	—	—	—	
<i>Atisāra</i>	—	—	<i>Utkleṣa</i> (Nausea)	—	—	<i>Avipāka</i> (Indigestion)	—	—	<i>Vijjala puriṣa</i> (Slimy stool) <i>Āmapuriṣa</i> (Undigested stool) <i>Viplutapuriṣa</i> (Stool which spreads and floats) <i>Avasādi puriṣa</i> (Stool which sinks and disolves in water) <i>Rūkṣamāla</i> (Rough stool) <i>Dravamāla</i> (Liquid stool) <i>Āmagandhimāla</i> (Stool having putrid smell) <i>Sarukmāla</i> (Voiding with pain) <i>Sasābdamāla</i> (Voiding with noise) <i>Vibandhavāta</i> (Retension of gas) Frequent motions	<i>Pitamāla</i> (Yellow stool) <i>Haritamāla</i> (Green stool) <i>Nilamāla</i> (Blue stool) <i>Kṛṣṇamāla</i> (Black stool) <i>Raktamāla</i> (Red stool) <i>Atidurgandhamāla</i> (Voiding stool having putrid smell)	<i>Snigdhāmāla</i> (Viscous stool) <i>Śvetāmāla</i> (Whitestool) <i>picchilāmāla</i> (Slimy stool) <i>Tantumātāmāla</i> (Stool having thready appearance) <i>Āma māla</i> (Stool having undigested food material) <i>Gurumāla</i> (Heavy stool) <i>Durgandhamāla</i> (Stool having putrid smell) <i>Ślaṣmopahita</i> (Mucoid stool) <i>Anubandha śūla</i> (Continued colicky pain) <i>Alpamāla</i> (Less quantity of stool) <i>Abhikṣṇa māla</i> (Frequent motions) <i>Sappravāhika māla</i> (Voiding with tenesmus)	—	

Disease	Symptoms relating to <i>Ūrdhva-amāśaya</i>				Symptoms relating to <i>Adha-amāśaya</i>				Symptoms relating to <i>Pakvāśaya</i>				Other relevant symptoms
	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	<i>Vāta</i>	<i>Pitta</i>	<i>Kapha</i>	Remarks	
<i>Gulma</i>	<i>Hṛdruka*</i> (Prae-cardial pain)	<i>Pīpāsa</i> (Thirst)	<i>Hṛllāsa</i> (Sensation of vomiting or nausea)	—	<i>Pārśva ruk</i> (Pain in flanks)	<i>Jīryatiśūla</i> (Pain during digestion)	—	—	<i>Vitsāṅga</i> (Retention of feces)	<i>Vidāha</i> (Burning sensation)	—	—	<i>Galāśoṣa</i> (Dryness in the throat)
	<i>Amsaruk*</i> (Pain in shoulder)	<i>Vidāha</i> (Burning Sensation)	<i>Gaurava</i> (Heaviness)		<i>Antravikujana</i> (Gurgling sound in the intestine)	<i>Vidāha</i> (Burning sensation)			<i>Vātasāṅga</i> (Retention of Gas)	<i>Vitabheda</i> (Diarrhoea)			<i>Vaktraśoṣa</i> (Dryness in mouth)
	<i>Bhukte mṛ-dutva</i> (Pain relieved after taking meals)		<i>Alparuk</i> (Less pain)		<i>Viṣamāgni</i> (Imbalanced digestion)	<i>Apakti</i> (No digestion)			<i>Kuṣṣiruk</i> (Pain in the lower abdomen)				<i>Aruci</i> (Distaste)
	<i>Ūrdhva Vāta</i> (Reverse peristalsis)		<i>Udgāra-bāhulya</i> (Excessive eructation)			<i>Āhāra-Vidāha</i> (Burning sensation by ingestion of food)			<i>Jirṇe prakopa</i> (Aggravation of the attack at the end of digestion)				<i>Tṛpti</i> (Satisfaction)
	<i>Kṛcchraśvāsa</i> (Dyspnoea)		<i>Chardi</i> (Emesis)										<i>Kaṭuvaktrata</i> (Sensation of acrid taste)
	*Referred pain								<i>Ātopa</i> (Distension with sound)				<i>Praseka</i> (Salivation)
<i>Amlapitta</i>	—	—	—	—	—	—	—	—	<i>Ānāha</i> (Flatulence)				<i>Madhurāśyātā</i> (Sensation of sweet taste in mouth)
	<i>Tiktodgāra</i> (Bitter eructation)	<i>Hṛd dāha*</i> (Burning sensation in prae-cardial region) Vomiting of green, yellow, blue, black and red coloured material, sour in taste and like water of flesh wash <i>Amlodgāra</i> (Acid eructation) *Referred burning sensation	<i>Hṛllāsa</i> (Nausea with palpitation) Vomiting of transparent slimy material mixed with mucus Aggravation after taking diet.			<i>Avipāka</i> (Indigestion) Aggravation during digestion			Aggravation after digestion	Passes motion of different types			<i>Aruci</i> (Distaste) <i>Tṛṣṇā</i> (Thirst)

[illegible]

APPENDIX-II

Table Showing the Result of Agni Bala Parikṣā (Jaṭharāgni) of Patients

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Duration	Agni bala	Parikṣā.					
								Urdhva āmāsaya vyāpāra	Adha-āmāsaya vyāpāra		Pakvāsaya vyāpāra.			
								Madhura pāka	Amla pāka	Pacana kriyā	Sāra kiṭṭa vibhājana	Rasa- Śoṣaṇa	Piṇḍi Karaṇa	Drava- śoṣaṇa
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Jamnadas Mohanlal	32	Male	Frequent motion pain, in abdomen, weakness, cough	Commenced from the convalescent period over two months of continuous fever	Paṭtika Grahaṇi	4 mns.	N.A.D.	N.A.D.	Manda (stool sank in water for all three days)	Impaired	Manda Daurbalya or weakness	Impaired	Impaired
2.	Smt. Lochaben Perumal	50	Female	Pain in the back side of the right leg, inability to use the limb; Giddiness	It started with neuralgic pain all over the body	Vatika Gṛdhrast	1½ yrs.	N.A.D.	N.A.D.	Vaiṣāmya (Sometimes mala is sāma & sometimes nirāma)	N.A.D.	N.A.D.	Impaired (Ajaśa-kṛdvat stool)	Impaired (Hard stool)
3.	Smt. Muktaben Prabhudas	22	Female	Excessive vaginal bleeding even after menstrual period, headache, pain in loins, Giddiness, Pandu	Derangement of the monthly Course with General malaise since last two years.	Rakta Pradara	6 mns.	N.A.D.	N.A.D.	Manda (Purīṣa sama for all three days)	N.A.D.	N.A.D.	Impaired (Ajaśa-kṛdvat mala)	Impaired (Hard stool)
4.	Thakarji Jetha	45	Male	Pain (Colicky) in right lumbar region 2-3 hours after taking meals, Śvāsa, Kāsa, Palpitation, pre-cardiac pain	Started with loss of appetite and loss of memory	Parīṇāma Śūla	1½ yrs.	N.A.D.	Impaired (Sometimes amla udgāra)	Viṣāma (Stool sometimes āma and sometimes nirāma.)	N.A.D.	N.A.D.	N.A.D.	N.A.D.
5.	Dulamji Devji	30	Male	Kāsa, discharge of frothy sputum, pain in the left chest, heart burning, weakness	Having history of Jirna pratiśyāya.	Śoṣa	15 dys.	N.A.D.	Impaired (Heart burn)	Impaired (Stool-āma for all three days)	N.A.D.	Impaired (Weakness emaciation)	N.A.D.	N.A.D.
6.	Abdul Rahim Hasam	45	Male	Pain in the right hypochondriac region, burning sensation, Kāsa Jvara	Started after excessive vomiting	Śūla (Vata-Paṭtika)	5-6yrs.	N.A.D.	Impaired (Burning sensation in stomach and pain)	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.
7.	Giridharlal Samji	25	Male	Mūtrādāha, Pus in urine, Pain in right gluteal region and lower mandibular region, dainya Udarasūla	These symptoms started after being attacked by a venereal disease)	Phirāṅga (Abhyantara)	1 yr.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.
8.	Ramjibhai	32	Male	Pain in dakṣiṇāyast pradeśa, no relation with food but aggravated at the end of digestion and weakness	Commenced with viṣṭambha	Śūla (Vatika)	3 mns.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	Impaired (weakness)	N.A.D.	N.A.D.

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Duration	Agni bala		Parikṣā					
								Urdhva āmāsyaya vyāpāra	Madhura Pāka	Adha-āmāsyaya vyāpāra		Pakvāsyaya Vyāpāra			
										Amla Pāka	Pācana kriyā	Sārakiṭṭa vibhājana	Rasa- śoṣaṇa	Piṇḍi- karaṇa	Drava- śoṣaṇa
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
9.	Jayasukhalal Varichand	20	Male	Udaraśūla sometimes motion with tenesmus and mucus, weakness, Tenderness in abdomen.	Had chronic dysentery few years back	Śūla as Upadrava of pravāhika	1½ yrs.	N.A.D.	N.A.D.	Impaired (Stool āma for all three days)	N.A.D.	Impaired (Weak- ness)	Impaired	Impaired (Some- times loose motion sometimes hard mo- tion)	
10.	Prabhaben Amritlal	48	Fe- male	Pallor, giddiness, Number of motions more, Inability for hard work, dyspnoea	Started with loose motions	Pāṇḍu (Vātaja)	3 mns.	N.A.D.	N.A.D.	Viṣma (Sometimes āma & sometimes nirāma stool)	N.A.D.	Impaired (Weak- ness)	Impaired	Impaired	
11.	Gaffar Kasam	20	Male	Koṣṭhe vāyupūrṇatā, Kaṭiśūla, Urahśūla, Hṛddrava, Weak- ness, Pain in joints, Sleepless- ness, Madhura udgāra (Sweet taste of eructation)	Arose after strenuous work	Koṣṭhāśrita vāta	4 mns.	Impaired (Sweet eructa- tion)	N.A.D.	Viṣma (Sometimes āma & sometimes nirāma stool)	N.A.D.	Impaired (Weak- ness)	N.A.D.	N.A.D.	
12.	Yuvansingh Kanaui	40	Male	Kāsa, Śvāsa, Kaphaniṣṭhivana Hṛddravatva constipation & Weakness	Suffered from syphilis earlier	Śiraja Gra- nṭhi (Aortic ane- urysm due to syphilis	5 yrs.	N.A.D.	N.A.D.	N.A.D.	Impaired (Consti- pation)	Impaired (Weak- ness)	N.A.D.	N.A.D.	
13.	Mansukhlal Mohanlal	24	Male	Weakness, Exhaustion by slight exercise, sleeplessness, loss of appetite	Śukrakṣaya (At night) since last year	Dhātukṣaya- Ja vāta vṛddhi	6 mns.	N.A.D.	N.A.D.	Impaired (Stool āma for all three days & Kṣudhā nāsa)	N.A.D.	Impaired (Weak- ness)	N.A.D.	N.A.D.	
14.	Asavi Mahamdia	32	Fe- male	Śvāsa, Kāsa, Jvara, loss of appetite, Debility, pain in bones and joints, Constipation	Started slowly with Kāsa.	Pratamaka svāsa	1 yr.	N.A.D.	N.A.D.	Viṣama (Stool some- times sinks in water & sometimes floats)	Impaired (Consti- pation)	Impaired (Weak- ness)	N.A.D.	N.A.D.	
15.	Lalbahadur Dipbahadur	28	Male	Colicky pain in abdomen, Dry- ness in throat, Pain in chest, Head & lumbar region	Developed such symptoms in the convalescence period of Kāmālā	Śūla (Vātaja)	1 mn.	N.A.D.	N.A.D.	Impaired (stool āma for all three days)	N.A.D.	N.A.D.	N.A.D.	N.A.D.	
16.	Mithabhai	70	Male	Frequent, painful micturation, flatulance, constipation sleep- lessness, giddiness	Started after chronic constipa- tion	Pauruṣa granthi bṛddhi (Enlarged prostate)	20 dys.	N.A.D.	N.A.D.	Viṣma (sometimes Pakvamala & some- times apakva)	Impaired (Consti- pation)	N.A.D.	N.A.D.	N.A.D.	

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Duration	Agni bala - Parikṣā						
								Urdhva āmāśaya vyāpāra	Adhā-āmāśaya vyāpāra		Pakvāśaya Vyāpāra			
									Amla Paka	Pacana kriyā	Sārakiṭṭa vibhājana	Rasa śoṣaṇa	Piṇḍi kāraṇa	Drava śoṣaṇa
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
17.	Nandlal Kalidas	30	Male	Pallor, stomatitis, Emaciation, weakness, liquid motion 7 to 8 times aday, Lethargy	Started with loose motion griping pain and mucoid stool	Pāṇḍu Atsāra Upadruta	6 mns.	N.A.D.	N.A.D.	Impaired (Stool āma for all three days)	Impaired (Diarrhoea)	Impaired (Weakness)	Impaired	Impaired (Loose motion)
18.	Pravin-kumar Mohanlal	15	Male	Pain in throat, cough, headache, excessive thirst	After attending local festival in hot sun and taking cold water just after it	Galā-Śundhi	*3 dys.	N.A.D.	N.A.D.	Impaired (Mala āma for all three days)	N.A.D.	N.A.D.	Impaired	Impaired (Semi-liquid motion)
19.	Maheshwar Rasiklal	15	Male	Unable to use his left upper and lower limb. Having fits at an interval of 15 dys to 2 months	After headache and murchā	Pakṣāghāta	1½ yrs.	N.A.D.	N.A.D.	Viṣma	N.A.D.	N.A.D.	Impaired	Impaired
20.	Mansukhlal Kubarji	11	Male	Unable to move his right upper & lower limb	Started suddenly after fever	Pakṣāghāta	2 yrs.	N.A.D.	N.A.D.	Impaired	N.A.D.	N.A.D.	Impaired	Impaired
21.	Jayantilal	11	Male	Itching and vesicles in the skin. Aggravates in rainy and winter season	Since his infancy	Pāmā	10 yrs.	N.A.D.	N.A.D.	Impaired	N.A.D.	N.A.D.	Impaired	Impaired
22.	Ibrahim Lakha	48	Male	Śvāsa, cough Headache	After excessive exhaustion	Śvāsa (Kṣudra)	2 mns.	N.A.D.	N.A.D.	Impaired (Stool āma for all three days)	N.A.D.	N.A.D.	N.A.D.	N.A.D.
23.	Somji Purushottam	35	Male	Pratīśyāya, sometimes haemoptysis weakness	After injury to chest	Urah kṣata	18 yrs.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	Impaired	N.A.D.
24.	Chanduben Bhagabanji	22	Female	Pallor, oedema in feet, dyspnoea after slight exhaustion constipation, Madhura udgāra (sweet eructation)	She was a patient of Gaṇḍupada Kṛmī and atsāra	Pāṇḍu	2 mns.	Impaired (Madhura Udgāra)	N.A.D.	N.A.D.	Impaired (Constipation)	Impaired (Weakness)	N.A.D.	N.A.D.
25.	Mansur ali Alibhai	30	Male	Pain in gluttal region, constipation	Started after chronic constipation, History of injury in lumbar region	Kaṭigatavāta (Abhīghātaja)	6 yrs.	N.A.D.	N.A.D.	Viṣama (Sometimes pakvamala and sometimes apakva)	Impaired (Constipation)	N.A.D.	N.A.D.	N.A.D.
26.	Garmaram Ranchoda	21	Male	Loss of appetite, constipation, loss of memory weakness	History of chronic night pollution	Atattvābhīni-veśa	2 mns.	N.A.D.	N.A.D.	Impaired	Impaired	Impaired	Impaired	Impaired
27.	Nandki-shore Bhagabanji	13	Male	Pain and swelling of joints of fingers, Impairment of the activities of the right arm.	History of Pūyameha and fever for 2 months.	Ānavāta (Pūyamehaja)	2 mns.	N.A.D.	N.A.D.	Impaired	N.A.D.	N.A.D.	N.A.D.	N.A.D.
28.	Debali Belji	17	Female	Śvāsa, Kāsa, Pain in chest, Headache, weakness	started after pratīśyāya.	Śvāsa (Tamaka)	2 yrs.	N.A.D.	N.A.D.	Impaired	Viṣama (Sometimes constipation & sometimes normal motion)	N.A.D.	Impaired	Viṣama (Sometimes hard & sometimes liquid)

No.	Name	Age	Sex	Chief complaints	Brief history	Disease	Duration	Agni bala Parikṣā						
								Urdhva āmāsyaya vyūpāra	Adha-āmāśaya vyūpāra		Pakvāśaya vyūpāra			
									Amla Pāka	Pācana Kriyā	Sarakitta vibhājana	Rasa śoṣana	Pittdi karana	Drava Śoṣana
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
29.	Saunya Anupala	30	Male	Sometimes <i>drava mala</i> , sometimes <i>baddha mala</i> . Pain in abdomen, Weakness, sometimes acid and sometimes sweet erucation, Pallor	Started with <i>Raktajapravāhika</i>	<i>Grahaṇi</i> (Pittakaphaja)	9 mns.	Impaired (Sweet eructation)	Impaired (acid eructation)	Impaired (Stool āma for all three days)	Impaired (Some times baddha & sometimes <i>dravamala</i>)	Impaired (Weakness)	<i>Viṣama</i>	<i>Viṣama</i>
30.	Sukurbhai Hasambhai	54	Male	<i>Ādhmāna</i> , <i>udaraśūla</i> , <i>Annavidāha</i> , Acid and sweet <i>utkleṣa</i> , sometimes <i>vamana</i> vertigo, Headache, Abdominal pain, aggravation of pain after digestion	Started after chronic constipation, Burning sensation of epigastrium Acid eructation, Nausea, etc.	<i>Gulma</i> (<i>Vātoja</i>)	2 yrs.	Impaired (Sweet eructation)	Impaired (acid ecupation)	Impaired (Stool āma for all three days)	N.A.D.	N.A.D.	Impaired	Impaired
31.	Navinchandra Ranchhod-das	23	Male	Rashes over the body stomatitis, constipation, at intervals of 1 to 3 days)	After an attack of Influenza (<i>Śleṣmika jvara</i>)	<i>Sapitta</i>	4 yrs.	N.A.D.	N.A.D.	N.A.D.	Impaired (constipation)	N.A.D.	N.A.D.	N.A.D.
32.	Premji Hamid	17	Male	<i>Śvāsa</i> (dyspnoea) <i>Bhrama</i> (Giddiness), <i>Sirahśūla</i> (Headache, <i>Dāhamūtra pravṛtti</i> Burning micturation), <i>Daurbalya</i> (weakness)	Commenced after suffering from <i>Prameha</i> (Gonorrhoea)	<i>Kṣudra śvāsa</i>	2 mns.	N.A.D.	N.A.D.	Impaired	N.A.D.	Impaired (Weakness)	N.A.D.	N.A.D.
33.	Babu Samji	14	Male	<i>Kāsa</i> , <i>Śvāsa</i> , <i>Daurbalya</i>	More in winter season	<i>Kṣudra śvāsa</i>	1 yr.	N.A.D.	N.A.D.	<i>Viṣama</i>	N.A.D.	Impaired (Weakness)	N.A.D.	N.A.D.
34.	J. Krishna	20	Male	Unable to have typing work in left hand due to spasm of fingers at the time of typing	Developed slowly	<i>Vātavyādhi</i> (<i>Anguligata</i>)	6 mns.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.	N.A.D.
35.	Rebunkumari	22	Female	Haemoptysis with cough, Pain in chest	Started bronchitis in her native place—Nepal.	<i>Kṣataja Kāsa</i>	4 yrs.	N.A.D.	N.A.D.	<i>Viṣama</i>	N.A.D.	N.A.D.	N.A.D.	N.A.D.
36.	Kahar Abdulrahim	7	Male	Inability to use left uper and right lower limb, <i>Māmsaśoṣa</i> (wasting of muscles)	After 14-15 days of continuous fever	<i>Paṅgu vāta</i>	6 yrs.	N.A.D.	N.A.D.	<i>Viṣama</i>	N.A.D.	N.A.D.	Impaired	Impaired
37.	Gangabai Trikamchand	40	Female	Giddiness, weakness, Exhaustion on slight exercise	Amenorrhoeasince last 12 years.	<i>Rasa kṣaya</i>	3 mns.	N.A.D.	N.A.D.	Impaired	N.A.D.	Impaired (Weakness)	N.A.D.	N.A.D.
38.	Raghiben Hirabai	30	Female	<i>Udgārabāhulya</i> , Pain in all over the abdomen, Headache, Pain in joints, constipation	Started with <i>Pratīśyāya</i> .	<i>Kṣmi</i> (<i>Purīṣaja</i>)	1½ yrs.	Impaired (<i>Udgāra</i>)	Impaired (<i>Udgāra</i>)	N.A.D.	Impaired (constipation)	N.A.D.	Impaired	Impaired

APPENDIX-III

Balapariksha Studied Togetherwith Ushmotpatti

APPENDIX-III

NO.	Names	Age	Diet	Agni	Previous night at bed time			Morning rising from bed			Before starting exercise			When attaining ardhasakti			Time taken to attain ardhasakti	Time taken for bilitation	Distance covered in exercise	Remarks.
					Pulse P. M.	Temp. (Degrees in far)	Resp. P. M.	Pulse P. M.	Temp. (Degree in far)	Resp. P. M.	Pulse P. M.	Temp. (Degree in far)	Resp. P. M.	Pulse P. M.	Temp. (Degree in far)	Resp. P. M.				
Volunteers																				
1.	B. Nanda	22	Non Vegetarian	Sama	76	98.4	18	62	96.4	14	78	97	16	128	98.8	33	5 mns	2 hrs 15 mns	720 ft	Running
2.	Banbiharilal	22	Vegetarian	"	80	98.4	17	73	96.5	13	73	96.5	13	150	96	26	10 "	35 "	—	Jumping
3.	V. S. Awasthi	22	"	"	72	97.2	20	52	96.8	18	60	97	18	132	98.4	34	10 "	34 "	1100 ft	Running
4.	G. C. Jain	23	"	"	72	97	19	52	96.8	19	66	97	23	100	97.6	34	15 "	30 "	—	Kusti
5.	H. S. Kasture	23	"	"	70	99.2	18	68	97	16	68	97	16	137	99.4	33	10 "	55 "	—	"
6.	R. J. Agnihotri	23	"	"	64	96.2	18	64	96	17	64	96.2	17	120	90.8	33	25 "	40 "	—	"
7.	A. P. Pandey	23	"	"	77	97	19	69	96	19	66	97	23	100	97.6	35	15 "	30 "	—	"
8.	D. N. Jha	25	"	"	75	98.4	18	55	98.2	13	52	96.4	16	103	97.7	25	5 "	90 "	660 ft	Running
9.	M. M. Kate	25	"	"	62	96.4	34	78	96.4	34	70	97	26	100	97.4	40	15 "	45 "	—	Kusti
10.	N. B. Sathe	25	"	"	86	97.4	16	85	96.4	16	85	96.4	18	96	97.4	25	15 "	45 "	—	"
11.	B. N. Phadke	25	"	"	80	97.8	19	70	97.4	16	70	97.6	17	122	98.4	30	15 "	45 "	—	"
12.	B. N. Pandey	25	"	"	83	97.6	20	67	96.4	16	07	96.4	18	115	96.4	30	5 "	2½ hrs	—	"
Patients																				
13.	Ranchhoda	22	"	"	72	98	22	57	97.2	18	70	97.4	20	132	103.6	30	5 "	50 mns	1 mile	Running
14.	Babu	14	"	"	60	97.4	26	60	96.4	26	60	96.4	26	102	96.6	32	9 "	2 hrs 15 mns	2700 ft	"
15.	Premji Hamid	17	"	"	55	96.2	29	55	94	26	60	95.5	29	144	97.1	28	15 "	2 hrs 10 mns	3700 ft	"



APPENDIX IV

Malaparikṣā according to Yogaratnākara

मलपरीक्षा^१

रुद्रतन्त्रात् :—

वातान्मले तु दृढता शुष्कता चापि जायते ।
 पीतता जायते पित्तात् शुक्लता श्लेष्मतो भवेत् ॥ १ ॥
 सन्निपाते च सर्वाणि लक्षणानि भवन्ति हि ।
 शुद्धितं फेनिलं रुचं धूमलं वातकोपतः ।
 वातरलेष्मविकारे च जायते कपिशं मलम् ॥ २ ॥
 बद्धं सुशुद्धितं पीतरयामं पित्तानिलाद् भवेत् ।
 पीतरवेतं श्लेष्मपित्तादीपस्मान्द्रं च पिच्छिलम् ॥ ३ ॥
 रयामं शुद्धितपीतामं बद्धरवेतं त्रिदोषतः ।
 दुर्गन्धः शीतलश्चैव विष्टोऽसर्गो यदा भवेत् ॥ ४ ॥
 तदाजीर्णमलं वैशैर्दोषैर्परिभण्यते ।
 कपिलं गुट्टियुक्तं च यदि वचोऽवलोक्यते ॥ ५ ॥
 प्रक्षीणमलदोषेण दूषिता परिकल्प्यते ।
 सितं महस्पृतिगन्धं मलं ज्ञेयं जलोदरे ॥ ६ ॥
 रयामं क्षयेऽवाभवति पीतं सकटिवेदनम् ।
 अतिकृष्णं चातिशुभ्रमतिपीतं तथाऽरुणम् ।
 मरणाय मलं किंतु मृशोष्णं मृत्पवे ध्रुवम् ॥ ७ ॥

अन्यच्च—

वातस्य च मलं कृष्णं ततः पित्तस्य पीतविट् ।
 रक्तवर्णमलं किञ्चिन्मलं श्वेतं कफोद्भवम् ॥ ८ ॥
 आमं वा श्लेष्मजं प्राहुर्मिश्रितं द्वन्द्वजं वदेत् ।
 अपक्वं स्यादजीर्णं तु पक्वं स्वच्छमलं भवेत् ॥ ९ ॥
 अर्यग्रौ पिण्डितं शुष्कं मन्दाग्रौ तु द्रवीकृतम् ।
 दुर्गन्धं चन्द्रिकायुक्तमसाध्यं मललक्षणम् ॥ १० ॥

१ रुद्रतन्त्रात् अन्यस्मात् तन्त्राच्च योगरत्नाकरेण दशमपृष्ठे उद्धृतम् ।

References showing difference between Agni and Pitta

पित्ताग्नयोः सम्बन्धः

ननु पित्ताग्नयोऽग्निराहोस्विरपित्तमेवाग्निरिति सन्देहः ? उच्यते, पित्तस्योष्णा-
दिगुणद्वारा आहारपाचनरंजनदर्शनादिकर्मणश्च न खलु पित्तस्यतिरेकेणान्यो-
ऽग्निः । तस्मादग्निरूपस्यैव पित्तस्य स्थानभेदात्पाचकरंजकसाधकालोचकभ्राज-
कसंज्ञाः ।

तथा च वाग्भटः—

पाचकं तिलमानं स्यात् काठिन्याच्चास्य दोषता ।
अनुगुह्यारयविकृतं पित्तं पाकोष्मदर्शनैः ॥
क्षुत्तुदुरुचिप्रभामेधाधीशौर्यतनुमार्दवैः ।
पित्तं पंचात्मकं तच्च पक्वामाक्षयमध्यगम् ॥ १० ॥
पंचभूतात्मकत्वेऽपि यत्तैजसगुणोद्भयम् ।
त्यक्तद्वयत्वं पादादिकर्मणाऽनलशब्दितम् ॥ ११ ॥
पचत्यन्नं विभजते सारकिट्टौ पृथक् तथा ।
तत्रस्थमेव पित्तानां क्षोषाणामप्यनुग्रहम् ।
करोति बलदानेन पाचकं नाम तस्मैतम् ॥ १२ ॥

ननु यदि पित्ताग्नयोरभेदस्तदा कथं धृतं पित्तस्य क्षमकमग्नेर्दीपकमिति । तथा
मत्स्याः पित्तं कुर्वन्ति न च तेऽग्निर्दीप्तिकरा इति । तथा पित्ताधिक्यात्तोष्णोऽग्नि-
रित्यपि कथं स्यात् । तथा “समदोषः समाग्निश्चेत्यपि” वक्तुं न युज्यते । तथा—
“द्रवं क्षिग्धमधोगं च पित्तं बहिनस्तोऽन्यथेति ।”
अत्रोच्यते पित्तमग्नेः सन्तताधिष्ठानम् ।

तथा चोक्तं तन्त्रान्तरे

अग्निभिन्नगुणैर्युक्तः पित्तं भिन्नगुणैस्तथा ।
द्रवं क्षिग्धमधोगं च पित्तं बहिनस्तोऽन्यथा ॥ १३ ॥
तस्मात् तेजोमयं पित्तं पित्तोष्मा यः स शक्तिमान् ।
स संचरति कुक्षिस्थः सर्वतो धमनीमुखैः ॥ १४ ॥
स कायाग्निः स कायोष्मा स पक्ता स च जीवनम् ।
अनन्यगतिरित्येवं देहे कायाग्निरुच्यते ॥ १५ ॥

तथा च मधुकोषे

“द्रवतेजः समुदायात्मकस्यापि पित्तस्य तेजो भागोऽग्निरिति । तेन पित्तम-
प्यग्निवन् मन्यते । अतितापितायोगोलकवत् । परमार्थतस्तु अग्निः पित्तादभिन्न
एवेति सिद्धान्तः ।

APPENDIX VII

A. Case of Agnibalapariksā

आयुर्वेदीयस्नातकोत्तरशिक्षणकेन्द्रम्, जामनगरम्

अभिलेख-परीक्षा-पत्रकम्

नाम : श्रीमान् मनसूर अह्नी अह्नीभाई

वयः : ३० वर्षाणि

लिंगम् : पुरुषः

प्रधानवेदन्ता : उवरः, यदा कदा विबन्धः, कटिनमलस्यागः, वामधरितवेदो रपशोसहस्रम्, यकृतप्रदेशे शूलम्, रपशोसहस्रं च, तीव्रं कटीशूलम्
संक्षिप्तमिति वृत्तम् : अष्टवर्षतः स्वप्ने बहुधा शुक्रवृत्तिः, मूत्रकृच्छ्रम्, सदाहमूत्रप्रवृत्तिः, तदनन्तरं पङ्कवर्षतः कठ्याभावातः, संजातः, ससद्वि-
सागप्रवृत्ति उवरः, शूलं, रपशोसहस्रं च ।

प्रवेशतिथिः : १८ : ८ : ५८

रोगः : उवरोपद्रुतधातुशयजा अभिघातजा च कटीघातवातवृद्धिः

तिथिः	आहार वर्णनं परिमाणं च		आहारगुणाः	मूलपरिमाण		मूलस्य वर्णनम्	पकापक-परीक्षा	मानस्यम्
	प्रातः	सायम्		समय	च			
प्रथम दिवसः १९-८-५८ दि०	ओदनम् २० तो०	कुशरा १० तो०	लघुः, दीपन सूध्य, वण्य च	२० तोलक, प्रातर्नव- वादनसमये (एकवारम्)		सुपरिपि ण्डितः कटिनः कृष्णः	पकः	वामधरित प्रदेशे यकृत प्रदेशे च शूलम्
स्याष्टवादनप्रातः २०-८-५८	सूत्रम् ५ तो० आकम् ८ तो०	गोधूमकप पैटिका ५ तो०						
दिनांकस्य प्रातरष्टवादनं यावत्	दुग्धम् २० तो०	आकम् ८ तो०						

तिथिः	आहारवर्जनं परिमाणं च		आहारगुणाः	मलपरिमाणं समयश्च	मलस्य वर्णनम्	पक्वाण्ड-परीक्षा	मन्तव्यम्
	प्रातः	सायम्					
द्वितीयदिवसः २०-८-५० स्य	—	—	—	३५ तो० प्रातर्नव वादन-समये (एकवारम्)	सुपरिपिण्डितः, अर्ध-घनः कृष्णः	आमः	—
प्रातरष्टवादानादारभ्य २१-८-५० स्य	—	—	—	३५ तो० प्रात-रष्टवादनसमये (एकवारम्)	—	—	—
प्रातरष्टवादनं यावत्	—	—	—	—	—	—	—

तृतीयदिवसः २१-८-५८ स्य

प्रातरष्टवादानादारभ्य २२-८-५८ स्य

प्रातरष्टवादनं यावत्

सामान्यविवेचनम्

: त्रिदिनं यावत् रोगी अग्निबल-परीक्षार्थं नियोजितः । प्रतिदिनं नातिवृत्तिं यावत् अनुमानेन ५६ तोलक-मितमाहारं, २२ तोलकमितं दुग्धं न्यददत् । स अनुपाततः प्रतिदिनं ३० तोलकमितं मलस्यागमकरोत् । अवशिष्टस्यान्नस्य स्वेदयूत्रादिमार्गेण निर्गमनं देहपोषणार्थं शक्युत्पादनार्थमूत्रोत्पादनार्थं च नियोजनमभूत् । उदरगौरवाभ्मानादिविष्टमलक्षणभावात् तस्य मलावरोध इति ज्ञायते ।

ऊर्ध्वाभाशयन्यापारः

: न सन्ति तत्र कश्चित् वेदना-शूलोद्गारप्रभृतयस्तस्मात् अशुक्रतोऽस्योदूर्ध्वमिच्छयापार इति प्रतिभाति ।

अध आमाशयन्यापारः

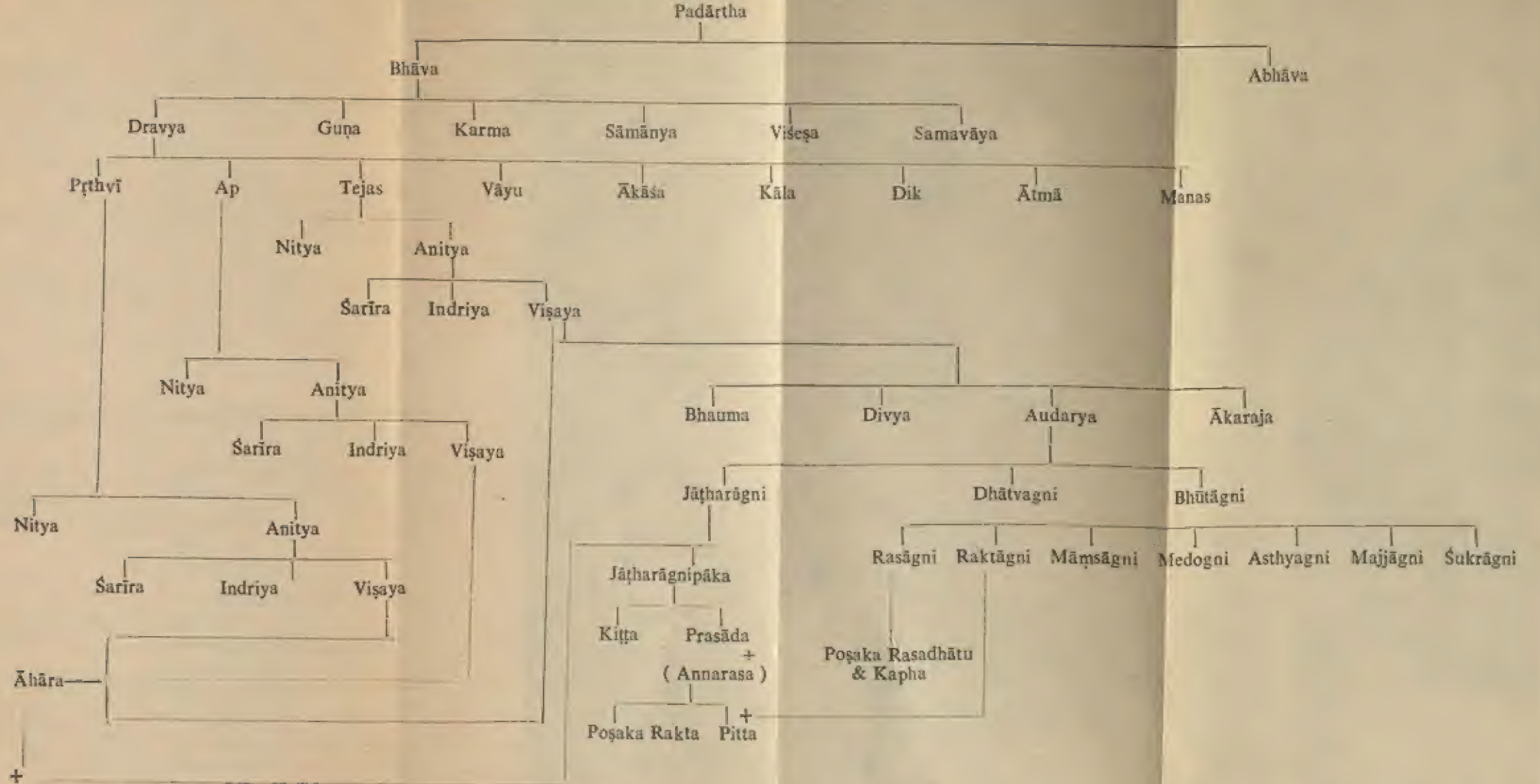
: प्रथमं दिवसे पक्वमलस्यागोऽभूत् । तदनन्तरं दिनद्वयं यावत् आममलस्यागः । तस्मात् विषमेषमाहारपचन-व्यवस्था इति ज्ञायते । रससोपन-व्यवस्थायां न इष्टा कश्चिद्विकृतिः । सारकिष्टविभजनमपि न संभवति इति विष्टभादनुमीयते ।

पक्वाशयन्यापारः

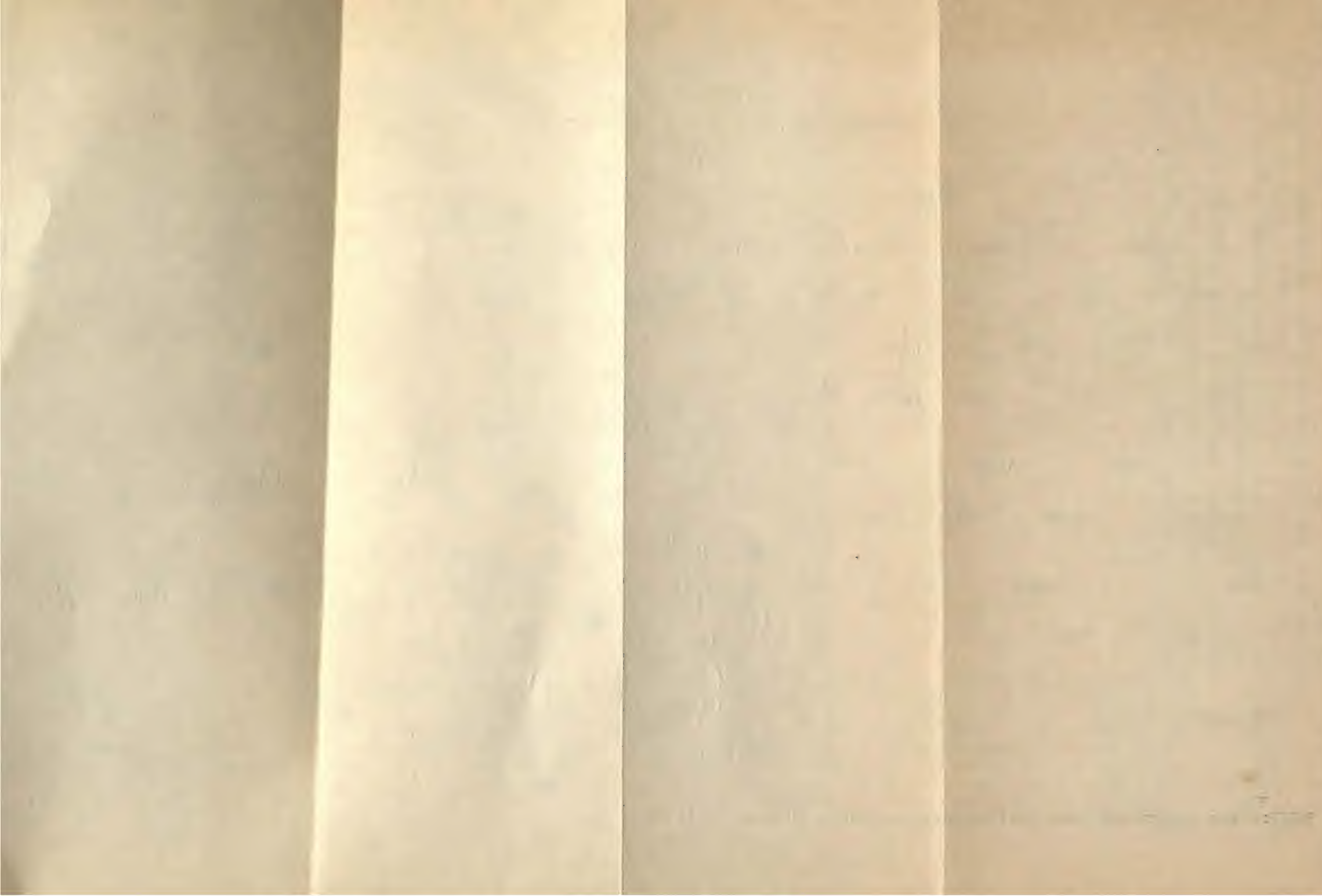
: दिनत्रयं यावत्, सुपरिपिण्डितमलस्यागात् सम्यक् विण्डिकरणक्रिया भवति इति ज्ञायते । द्रवशोषणं चापि सम्यगापच्यति नातिद्रवः नातिघनपुरीषोऽसर्गभावात् ।

APPENDIX VI

Scheme to Show the Relation Between Agni & Pitta.



NOTE:—Taken with certain alteration from Dinanātha's commentary on Mādhavanidāna 55 : 32



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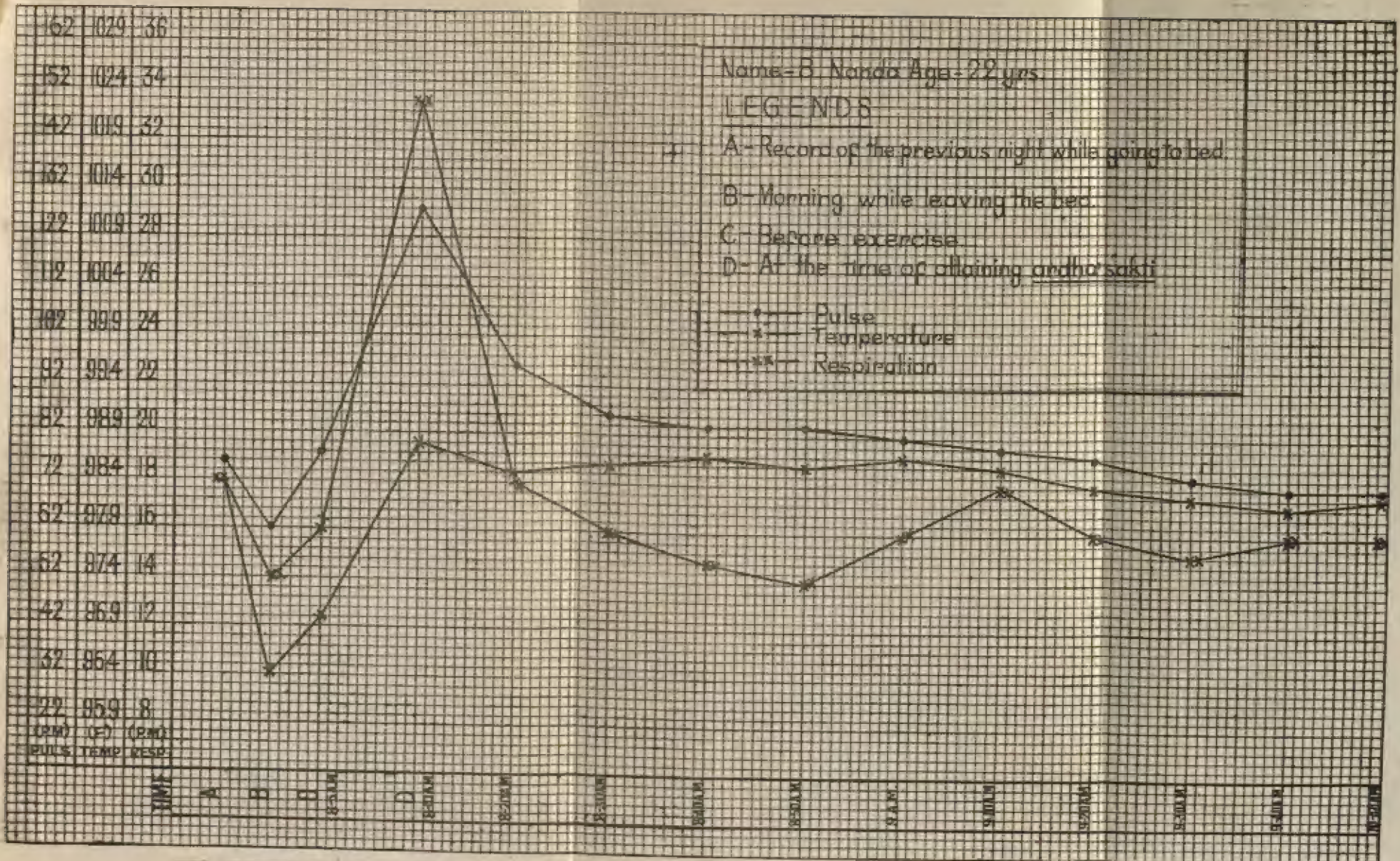
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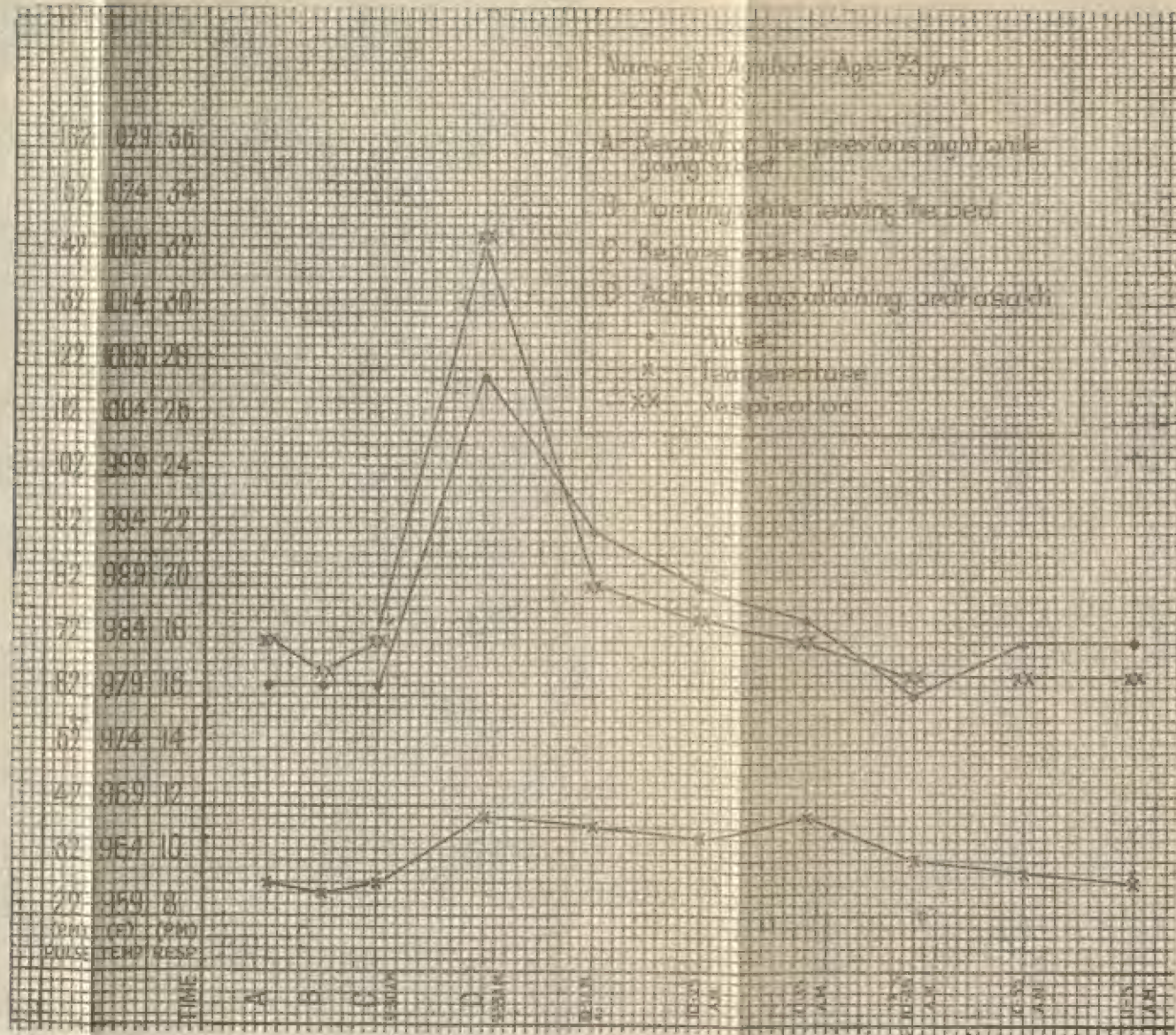
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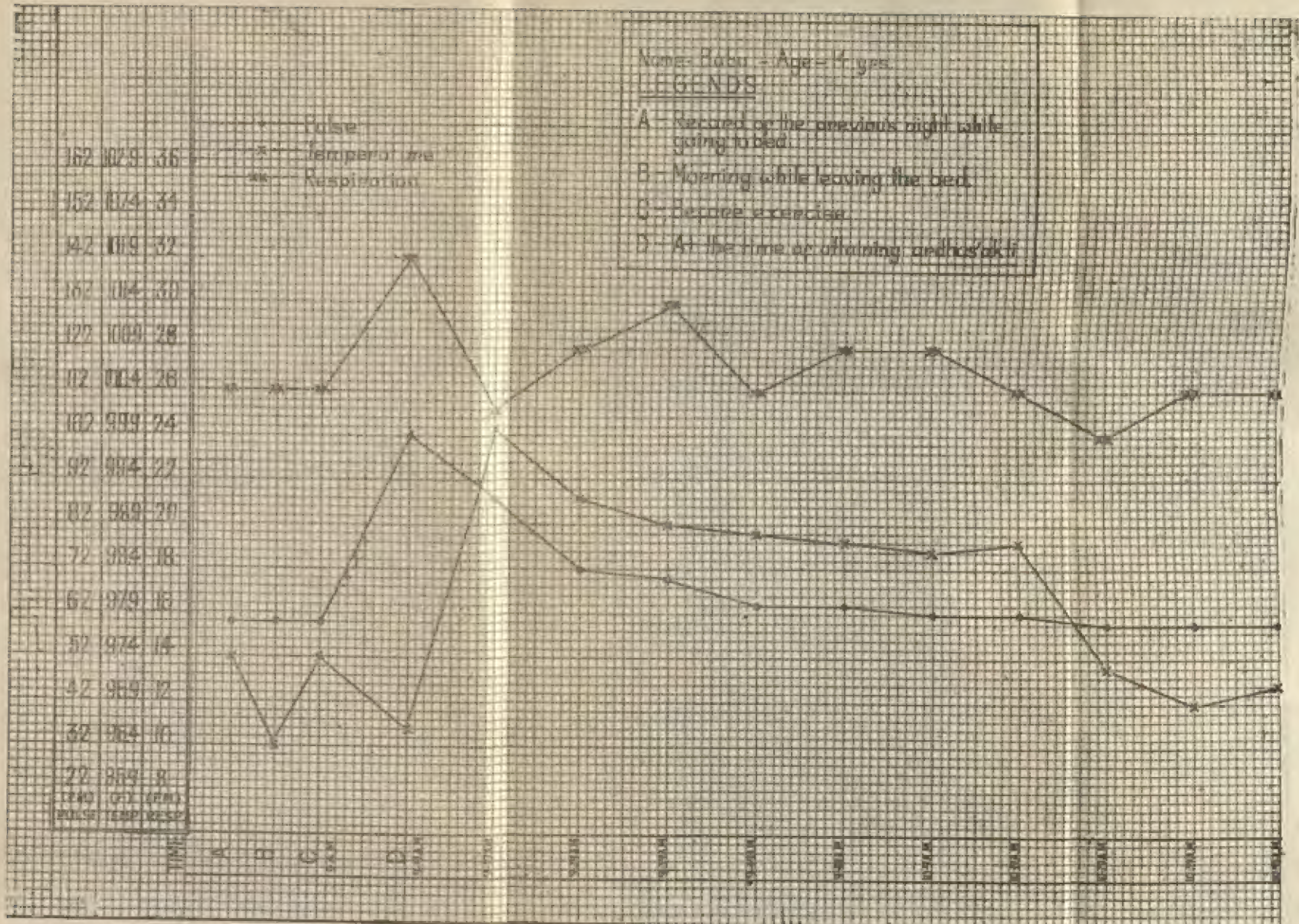
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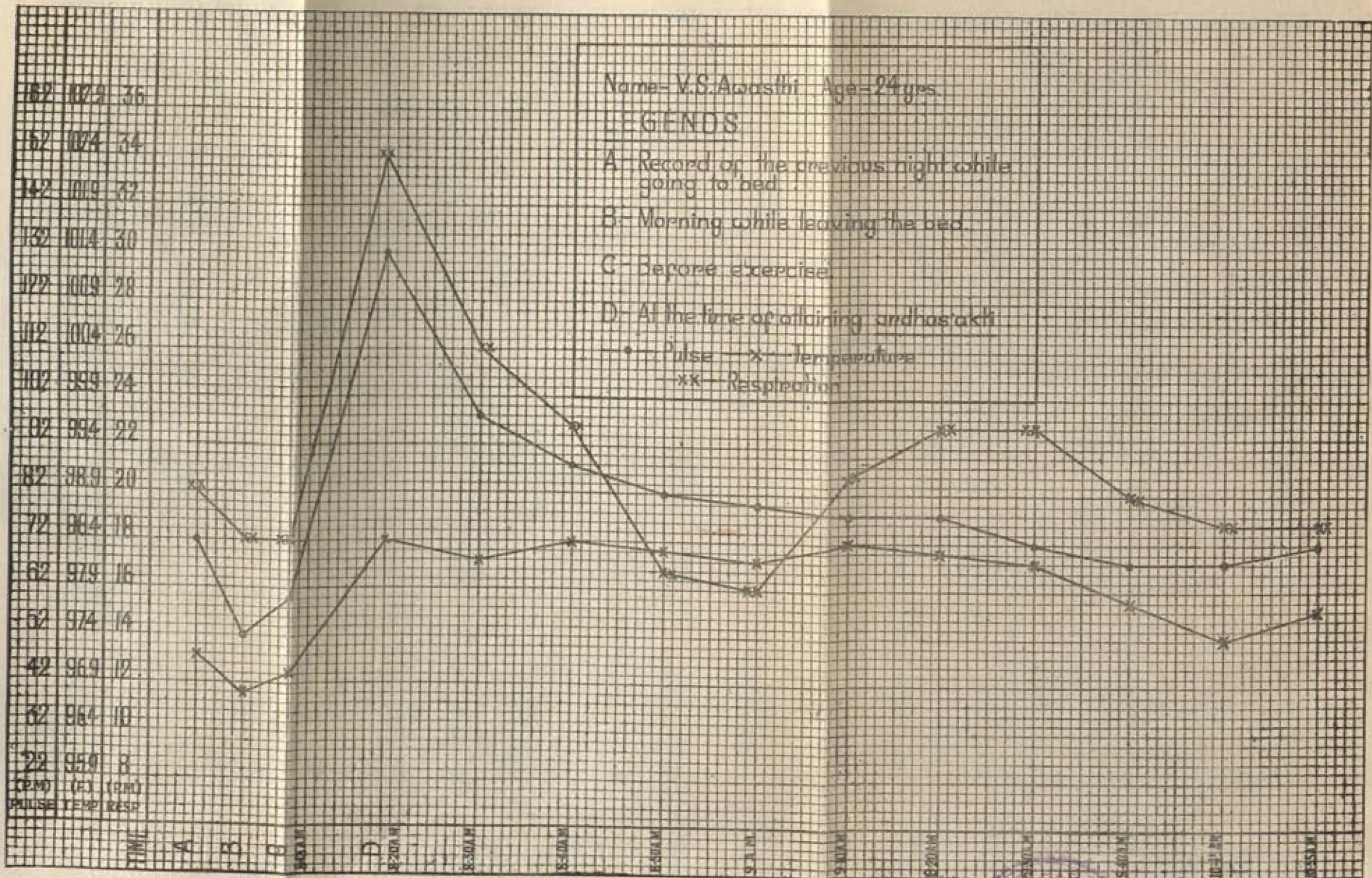
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